Exploring physical rehabilitation in long-term care

by

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AUTHOR'S DECLARATION

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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ABSTRACT

The aging population requiring residential support in long-term care (LTC) continues to grow, as does their need for multidisciplinary interventions including physical rehabilitation (PR). In tandem, quality of care in LTC has also been of increasing concern to researchers and the public. A controversial funding change in Ontario in 2013 has led to questions about the quality of rehabilitative care provided in LTC and the need for leadership in the PR in LTC sector.

The objectives of the thesis were to: 1) To synthesize what is known about a) any tools to determine who should receive PR services; b) which PR services have been evaluated; and c) how they have been evaluated. 2) Using the results of objective 1 and stakeholder consultation to determine which facility-level quality indicators (QIs) could be used to evaluate PR in LTC; 3) To determine the relationship between PR and the QIs decided upon in objective 2; and 4) To evaluate the impact of the funding change in Ontario in 2013 using the QIs from objective 2.

First, a structured scoping review synthesized a description of the PR interventions in LTC and the outcomes used to evaluate them. A consensus meeting using nominal group technique determined which domains of QIs could be used to evaluate PR in LTC. The third study evaluated the relationship between PR and the QIs identified in study two using multilevel modelling. Finally, the fourth study evaluated the effect of the funding change on the same QIs.

The literature review revealed that intervention trials of PR in LTC are most commonly delivered and evaluated at the resident-level and assess performance-based measures, ADLs, and mood as outcomes. Few studies have used facility-level measures to evaluate rehabilitation. However, the consensus process determined that ADLs and falls should be used for evaluation, though exact specifications of an ADL QI could not be decided upon. Analysis of seven ADL and one falls QI revealed wide variation across four Canadian provinces, with no consistent relationship with the proportion of residents receiving rehabilitation services except for nursing rehabilitation programs in Alberta. The policy change in Ontario in 2013 saw fewer residents receiving physical therapy (PT) overall, but was associated with improved performance on several ADL QIs. However, not all relationships were positive. The proportion of residents receiving the no PT and the least time intense PT was associated with poorer performance on two of the ADL QIs after the policy change.

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DEDICATION

I dedicate this thesis to all the people who have helped and supported me along the way. First, to my soon-to-be husband, Dave. Your patience and kindness, unbeknownst to you, gave me the strength and courage to take on days that I felt like giving up. You are always willing to let me vent, cry, yell, and run it all out. You have no idea how much this has helped me. Your steady support is unmatched. Here's to starting our lives together as partners in crime! Second, to my family. I dedicate this to my parents for encouraging me to pursue my passions, even if it's not the path well travelled, and for supporting me through the ups and downs of completing a doctorate. I also dedicate this thesis to my sister for showing me that hard work and perseverance pay off, and for giving me real world advice about applying to and completing a doctoral program. Third, I dedicate this thesis to Dr. Lora Giangregorio and my colleagues in the BonES lab at the University of Waterloo. You have supported and challenged me throughout my four years at Waterloo. I have been so honoured to work with each undergrad and master's student, co-op placement, and post-doctoral fellow who has passed through the lab. Sorry that Monday morning baked goods will be ending! And lastly, I dedicate this thesis to the residents and families I had the honour of working with throughout my practice in long-term care. Your perseverance and love for life are what inspired me to pursue this journey, and will continue to drive my pursuit of improving rehabilitation for older adults. I hope that I will be able to improve services to meet your needs, and to make your voices heard.

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LIST OF ABBREVIATIONS

ADL – activities of daily living

CAP – clinical assessment protocol

CPS - cognitive performance scale

EQ5D - EuroQol 5-dimension quality of life scale

LTC – long-term care

OHIP – Ontario Health Insurance Plan

OT – occupational therapy

OTA – occupational therapy assistant

PR – physical rehabilitation

PSI - patient safety indicator

PT – physical therapy

PTA – physical therapy assistant

QI – quality indicator

RAI-MDS – resident assessment instrument – minimum data set

RUG - resource utilization group

SLP – speech language pathology

WHO - World Health Organization

CHAPTER 1 – GENERAL INTRODUCTION

As the proportion of older adults continues to increase, so does the number who require residential support because of functional decline related to complex, chronic diseases. In Canada, 7.1% of the older adult population resides in long-term care (LTC) homes and the rate is projected to double within the next 20 years.[1] In LTC, 95% of residents require at least some assistance with activities of daily living (ADLs), while more than 80% required extensive care.[2] To prevent further functional decline and to maintain independence, residents often require the support of a multidisciplinary team including physical rehabilitation (PR) services. However, significant financial and political constraints limit the availability of PR services in LTC. As an example, in August 2013, there was a significant, controversial policy introduced that changed how PR is delivered in LTC in Ontario.[3] Leadership is required to plan, deliver and evaluate PR services in LTC for the growing aging population who will require support in the changing health care climate. Accordingly, policy makers and LTC providers would benefit from a thorough understanding of how decisions can be made about who should receive rehabilitation services, what services could entail, and how they can be evaluated.

PR is defined by the Canadian Physiotherapy Association as:

"*Promoting optimal mobility, physical activity and overall health and wellness; Preventing disease, injury, and disability; Managing acute and chronic conditions, activity limitations, and participation restrictions; Improving and*

maintaining optimal functional independence and physical performance; Rehabilitating injury and the effects of disease or disability with therapeutic exercise programs and other interventions; and Educating and planning maintenance and support programs to prevent re-occurrence, re-injury or functional decline." (http://www.physiotherapy.ca/getmedia/e3f53048-d8e0-416b-9c9d-38277c0e6643/DoPEN(final).pdf.aspx)[4]

PR can be active (e.g., participating in exercise) or passive (e.g., therapeutic modalities such as ultrasound or whole-body vibration), and can be delivered in a group setting or on an individual basis by a physiotherapist, kinesiologist, fitness instructor, nurse or other staff involved in the LTC home.

Though many residents could benefit from PR services, few receive these services. Receipt of PR services appears to be related to location and specific characteristics of residents.[5-8] When comparisons are made across countries, the proportion of LTC residents receiving rehabilitation varied from 10% in the United Kingdom[5] to 90% in the Netherlands.[7] Rehabilitation usage rates within a country can also vary widely. For example, across Canada they varied from 5.8 to 29.5%[8], while in the Netherlands they ranged from 35 to 90%.[7] Older adults admitted for continuing care with poorer cognition and mood disorders such as depression are reported to be less likely to receive rehabilitation services.[6-8] Though age and cognition seem to be barriers to receiving rehabilitation, evidence suggests that even older residents with dementia can benefit from rehabilitation interventions.[9-11] The contrast between who is actually receiving services and who evidence suggests can benefit begs the

questions: who should be receiving PR in LTC and how can it be decided who should receive them?

Aside from investigating who should be receiving services, a broad understanding of what PR interventions have been evaluated in the literature is also necessary for planning and delivery of services. The results of a systematic review reveal that there is a lack of evidence surrounding PR interventions in the literature.[12] First, there is heterogeneity in the models of delivery, staff providing, time allocated to, and goals of PR interventions.[12] Additionally, though the review considered 67 trials, a broad perspective on PR interventions was not considered.[12] For example, both active PR (i.e., where the resident participates in physical exertion) and passive PR (i.e., administered via external stimulation) were not considered, nor was the full spectrum of professionals who could be involved in delivering services (e.g., physical therapists, occupational therapists, kinesiologists, nurses). Researchers, clinicians, and policy-makers require a broad view of what has been studied given the dearth of evidence currently available on PR interventions in LTC and the multidisciplinary nature of the LTC context.

Thoughtful evaluation is a critical aspect of planning, delivering, and evaluating PR services. Choosing appropriate outcomes at the pertinent level (i.e., resident, facility, system) ensures relevant constructs are used for evaluation, PR is of benefit to residents, and for monitoring of quality of care. Measuring outcomes at multiple levels of the healthcare system is also required to facilitate quality improvement.[13,14] An overabundance of constructs has been used to evaluate PR

at the resident-level. However, measurement at the facility- and system-level is lacking.[12] While resident-level evaluation is useful for evaluating resident progress and for treatment planning, facility- and system-level evaluation allow for comparison across and within homes.[13,14] There are no established facility- or system-level measures for evaluating PR in LTC.

Therefore, the objectives of this thesis were: 1) to identify validated tools for determining PR service eligibility; 2) to describe published PR interventions and how they have been evaluated; 3) to decide on facility-level measures that could be used to evaluate PR; 4) to explore the relationship between facility-level measures and rehabilitation services; and 5) to use those measures to evaluate the effect of the policy change that occurred in Ontario LTC homes in 2013. The thesis is organized into four studies described in Chapter 2 to 6. The first study is a scoping review that addresses objectives 1 and 2, and is described in Chapter 2 and 3. The second study, described in Chapter 4, combines the results of the scoping review and a consensus process to address objective 3. Chapter 5 describes the third study addressing objective 4 by examining the relationship between rehabilitation and facility-level quality indicators. The final study examining the effect of the policy change is described in Chapter 6. Chapter 7 provides a general discussion of the thesis results.

CHAPTER 2 – STUDY 1

Protocol for a scoping review of physical rehabilitation interventions in long-term care: tools, models of delivery, outcomes and quality indicators

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INTRODUCTION

Currently, 7.1% of all older adults in Canada live in long-term care (LTC) and it has been estimated that by the year 2036 the number of individuals living in institutional care facilities will more than double.[1] Residents in LTC often have combinations of threats to well-being including pain, disability, and mental health issues.[15] Therefore, they often require support by a multidisciplinary team including those providing physical rehabilitation (PR).[15,16]

PR is defined by The Canadian Physiotherapy Association as:

"*Promoting optimal mobility, physical activity and overall health and wellness; Preventing disease, injury, and disability; Managing acute and chronic conditions, activity limitations, and participation restrictions; Improving and maintaining optimal functional independence and physical performance; Rehabilitating injury and the effects of disease or disability with therapeutic exercise programs and other interventions; and Educating and planning maintenance and support programs to prevent re-occurrence, re-injury or*

functional decline." (http://www.physiotherapy.ca/getmedia/e3f53048-d8e0-416b-9c9d-38277c0e6643/DoPEN(final).pdf.aspx)[4]

PR can therefore be active involving physical exertion by the resident (e.g., participating in exercise) or passive via external stimulation (e.g., therapeutic modalities such as ultrasound or whole body vibration). PR can be delivered in a group setting or on an individual basis by a physiotherapist, kinesiologist, fitness instructor, nurse or other staff involved in the LTC home.

The goal of PR to maintain and improve mobility, physical activity and overall health and wellness is clear, however identifying interventions and models of delivery for residents in LTC remain to be determined.[4,17] A systematic review of active PR in LTC concluded that there is a lack of evidence in this area and revealed heterogeneity in the goals of interventions as well as in the time allocated to PR, the staff delivering PR, and the model of delivery of PR.[17] For example, some PR interventions focus on general strength and balance and are delivered by a PR assistant in a group format for 45 minutes three times per week, while others focus on specific activities of daily living and are delivered by a restorative care nurse on an individual basis for one hour daily.[17] Additionally, active and passive PR techniques have not been considered to date in one review.

In addition to heterogeneity surrounding PR interventions and which health care member delivers PR care, the outcomes used to evaluate PR are not consistent. A plethora of constructs and outcome measures have been used to evaluate the effect of PR at the resident-level; yet constructs measured to evaluate PR at the

facility- or system-level are limited. Constructs measured to evaluate PR at the resident-level include: activities of daily living, balance, muscle power, flexibility, exercise tolerance, physical activity, mood, cognitive performance, quality of life, fear of falling, and perceived health status.[17] While resident level evaluation is useful for PR treatment planning and evaluation, facility- and system-level evaluation can allow for comparison of outcomes within and across LTC homes, and provide support for quality improvement strategies. Indeed, it has been suggested that measurement of outcomes, processes, and structures at multiple levels of the healthcare system are required to facilitate improvement.[13,14]

Quality indicators (QI) are used to monitor and improve quality of care in LTC at the facility- and system-level.[18,19] A quality indicator is defined as resident-level data aggregated at the facility level and expressed as fractions, where the numerator reflects the number of residents with a particular outcome and the denominator reflects the number of residents at risk for developing an outcome who are not otherwise excluded from the QI.[18] In Ontario, 12 QIs are publicly reported for each LTC facility through the Canadian Institute of Health Information (https://yourhealthsystem.cihi.ca/hsp/?lang=en) including: wait times, incontinence, activities of daily living, effective cognitive function, pain, emergency department visits, falls, pressure ulcers, restraints, medication safety, human health resources, and infections.[20] Existing QIs have the potential to reflect the quality of rehabilitative care at the facility level within and across

LTC homes. Thus, there is a need to determine which would best reflect an evaluation of PR.

Uncertainty surrounding interventions, delivery and evaluation of outcomes of PR in LTC is compounded by additional uncertainty regarding which residents in LTC might benefit from PR services in LTC. To date, there are jurisdictional differences in utilization rates for PR across Canada and internationally.[6,7,15] Certain studies reveal that older residents with cognitive impairment are less likely to receive PR services[6,7] despite evidence supporting the efficacy of PR for improving function for individuals with cognitive impairment.[9,11,21] To add to the complexity of who might benefit from PR in LTC there are different categories of residents in LTC such as those admitted for short stays with a definite number of days to rehabilitate after an acute event and return to the community compared with those admitted for long stays requiring ongoing care.[22] While the majority of residents in LTC in Canada are in long-stay programs, such that they require residence in LTC indefinitely, there has recently been an increase in the number of short-stay programs in LTC in Ontario.[23] There is also international variation regarding the goals and length of stay for residents in LTC. For example, in the United States, residents admitted to skilled nursing facilities often have the goal of returning home, while there are wards dedicated to PR in European LTC homes.[7,24] The length of stay and goals for PR must be considered in goal setting, delivery and allocation of rehabilitative care.

The aim of the scoping review is to synthesize evidence regarding which active and passive PR interventions and models of delivery have been evaluated, what outcomes and quality indicators have been used to evaluate them and tools or models used to determine eligibility for services. The synthesis will identify the scope of PR interventions and how they have been evaluated, which can be used to inform future research and policy-making. A scoping review has been chosen to provide breadth on the topic, rather than depth, and to include a variety of publication types including grey literature (e.g., policy papers, reports, and clinical practice guidelines).[25]

The objectives of the scoping review are to:

1) Characterize the types of active and passive PR interventions (e.g., therapeutic goal, frequency, mode of delivery) that have been evaluated for efficacy /effectiveness in LTC

2) Identify which outcomes at the person-, facility- or system-level have been used when evaluating the efficacy/effectiveness of PR interventions in LTC

3) Map the identified outcomes used when evaluating the efficacy/effectiveness of PR in LTC to the existing QIs in LTC across Ontario, to inform future program design and implementation

4) Characterize any tools or models that exist or have been validated for decision-making in the allocation of PR resources in LTC

5) Use the available evidence and stakeholder consultation to identify which existing or new outcomes and QIs could be used to evaluate PR at the person, facility or system level.

METHODS AND ANALYSIS

We will use the framework proposed by Arksey and O'Malley[25] and the suggestions proposed by Levac et al.[26] to guide the scoping review methodology.

1. Research questions: The team defined the concepts, target population and outcomes of interest, and has drafted three main research questions for the scoping review. The main concept of interest is PR in LTC. The Canadian Physiotherapy Association's Description of physical therapy in Canada, 2012, will be used to define PR (see introduction).

(http://www.physiotherapy.ca/getmedia/e3f53048-d8e0-416b-9c9d 38277c0e6643/DoPEN(final).pdf.aspx)[4]

The population of interest includes adults aged 65 years or older residing in a LTC facility. LTC will be defined as a home for residents who are unable to live independently, requiring access to nursing, personal care, support and/or supervision.[27] The research questions and outcomes of interest are outlined in Table 1.

Table 1. Research question and outcomes of interest

Research question	Outcomes of interest
1) What types of PR have been evaluated for efficacy or effectiveness in LTC?	Types of PR interventions including: - therapeutic goals (e.g. improve strength, decrease falls) - frequency of intervention (e.g. daily, 3x/week) - modes of delivery (e.g. delegated care, direct care)
2) Which outcomes or quality indicators have been used when evaluating the efficacy or effectiveness of PR interventions in LTC?	Outcomes or quality indicators* used at the: - resident-level (e.g. ADL functioning) - facility-level (e.g. monthly falls rate) - system-level (e.g. acute care transfers)
3) What tools or models exist or have been validated for decision-making in the allocation of PR resources in LTC?	Tools or models for allocation of resources (e.g. criteria or algorithms for determining who receives services)

*Quality indicators will be defined as person-level data aggregated at the facility level and expressed as fractions, where the numerator reflects the number of resident's with a particular outcome and the denominator reflects the number of residents at risk for developing an outcome who are not otherwise excluded from the QI.[18]

PR=physical rehabilitation

LTC=long-term care

2. Identifying relevant studies:

a) Licensed Journal Databases: Systematic searches for peer reviewed articles will be conducted in the following licensed databases: MEDLINE Pubmed (1946 – present), EMBASE Ovid (1974 – present), CINAHL (1981 – present), Cochrane Database of Systematic Reviews (1994 – present), the Physiotherapy Evidence Database (PEDro), and the Occupational Therapy Systematic

Evaluation of Evidence database (OTseeker). The searches will be limited to papers with full texts in English. The search strategies will use text and indexing terms to capture the key concepts: LTC, PR, interventions that have been evaluated, elderly, decisions regarding resource allocation, tools to assist in decision making, and evaluation including quality indicators (see Appendix 1 for an example of the search filters run in Medline). Concepts will combined using the Boolean Operator AND, and the search terms within each concept will be combined with OR. Keywords will be searched using truncation and phrase symbols when appropriate to ensure precise and comprehensive results. Results from one research question's search results may be applicable to a different question; therefore, the results from both searches will be combined (using the Boolean Operator OR) so there will be one final search for each database.

b) Grey Literature: A grey literature search will be conducted to find clinical trials in progress, practice guidelines not indexed in databases, policy, government reports, legislation, and conference papers using the following websites: Canadian Institute for Health Information; Ministry of Health and LTC; National Institute of Health, and the Government and Legislative Libraries Online Publications Portal, Canadian Physiotherapy Association, Ontario Long-term Care Association, American Academy of Physical Medicine and Rehabilitation, and the University of Waterloo's library catalogue (a full government depository library). We will also do a broad Google search, focusing on the first few pages of relevancy ranked results, until the results become mostly irrelevant. The websites, search engine and catalogue will be

searched for documents using selected, common keywords from Appendix 1, and then the found documents will be searched for appropriate keywords to identify relevant information.

c) Hand Searching: We will hand search reference lists of included articles for more relevant citations, and we will identify and contact researchers or opinion leaders in the area of PR in LTC.

3. Selection of studies for inclusion: Two team members (CM and one other) will review the title, abstract and descriptors of identified citations and apply the inclusion and exclusion criteria discussed below. If there is not enough information to make an informed decision, the article will be retrieved. Two team members will then independently assess all full text studies/reports for inclusion by applying the inclusion and exclusion criteria again. Disagreement will be resolved through discussion or third party adjudication. For the grey literature search, the two team members will apply the inclusion and exclusion criteria to the citations gathered from hand searching and grey literature searches as those citations are found. The searches for, and selection of, these documents will happen concurrently. The screening process will be pilot tested on 5% of both papers obtained from licensed databases and the grey literature search. The screening forms will be modified if there is low agreement between the two team members as indicated by a kappa statistic less than 0.5.

Inclusion criteria: The following research and study designs will be considered: case studies, mixed-methods, prospective, longitudinal, retrospective case-control, randomized controlled trials, quasi-randomized clinical trials or

controlled clinical trials, clinical practice guidelines, systematic reviews, and relevant reports generated by policy makers. For a study to be included, more than half of the participants will have to be elderly, defined as individuals of a median or mean age of ≥65 years of age, and residing in a LTC facility defined as a home for residents who are unable to live independently, requiring access to nursing, personal care, support and/or supervision. If a study has participants from multiple populations (e.g., multiple ages or settings), results relating to the population of interest (i.e. residents ≥65 years of age residing in LTC) must be presented separately for the study to be included. Included papers must focus on PR as defined by the Canadian Physiotherapy Association. To be included, studies or documents must focus on either a PR intervention, a tool, model or framework for system level decision making regarding eligibility for PR services, or describe, evaluate or provide evidence for a quality indicator that could be used to evaluate PR. *Exclusion criteria:* Papers that discuss tools or models that have not been validated will be excluded. For a tool or model to be considered validated proof of face, construct, or criterion validity must be demonstrated. In addition, non-English full text papers, clinical commentaries, editorials, interviews, lectures, legal cases, letters, newspaper articles, patient education handout, abstracts or unpublished literature will be excluded.

4. Charting the data: A data abstraction form was compiled with input from the research team. The data abstraction form will be pilot tested on a random sample of 10 articles and revised as needed. Two team members will then use the pre-tested data abstraction form to abstract data from included studies, tools,

or models. Disagreement will be resolved by consensus or third party adjudication. Charting will be an iterative process with the research team continually updating the data abstraction form. The data that will be abstracted is described in Table 2.

Table 2. Data abstraction for the three research questions

	Data to be Abstracted
Summary	1. Title of the study 2. Authors of the study 3. Location of study (country) 4. Which research question does the study address? (1, 2 and/or 3) 5. Type of literature (published peer reviewed article, report, policy paper) 6. Length of stay of residents (short or long): as defined by the Ontario Ministry of Health and Long-term Care, long stay residents are those residing in the home for more than 90 days (15). 7. Description of participants (age, sex, cognition, inclusion/exclusion criteria) 8. Description of facility or unit-type (e.g., specialized nursing facility, nursing home, long-term care facility)
Research question 1: Interventions	1. Study design - Description of study design e.g., randomized controlled trial, systematic review, etc.) - Level of evidence I-VI, based on study design (from *Evidence-based practice in nursing health care: a guide to best practice*, (23)) 2. Description of intervention: - therapeutic goals - frequency - intensity - time/volume - duration - -type (e.g., strength, balance, multicomponent) - -who delivered the intervention - level of intervention delivery (person-, facility-, system-) - which QI(s) is/are addressed
Research question 2: Outcomes and Quality Indicators	A) Outcomes from trials: 1. Outcome of interest: construct(s) measured, outcome measures used 2. Outcome level: person, facility, or system B) Quality indicators: 1. Name of quality indicator 2. Description of quality indicator 3. Description of calculation of quality indicator (numerator, denominator, risk adjustment, inclusion/exclusion criteria) 4. Evidence to support the use of the quality indicator: - Description of data source for derivation of QI

	- stakeholder engagement process (yes/no, description of process) - average prevalence/incidence, variance - sensitivity to change, timeframe for improvement
Research question 3: Tools, Models, or Frameworks for decision-making	1. Name of tool, model, or framework 2. Description of tool, model, or framework 3. Population tool, model or framework used with (e.g. short or long stay) 4. Country of implementation 3. Description of validation or implementation process for tool, model or framework

QI=quality indicator

5. Summarizing and reporting the findings: We will display information sources according to the research question addressed.

Summary: Infographics such as bar graphs and maps will be used to visually display year of publication, country of origin, proportion of articles involving short and long-stay residents, and the proportion of articles that address each research question.

Research question 1: Interventions: Interventions will be sorted and presented based on the QI they address (see below). Under each QI the interventions will then be grouped based on the level of intervention delivery (person-, facility-, or system-) and a summary of the level of evidence based on the study design[28] will be presented. Under each level of intervention, a description of the type, frequency, intensity, time/volume and person delivering the intervention will be presented in table format. The types of PR intervention will be grouped based on the target of each intervention, for example interventions will be grouped based on those targeting strength, balance, aerobic endurance, functional skills

training or those that are “multi-target”, involving at least two of the previously mentioned targets.

Research question 2 - Outcomes and quality indicators: The frequency of the constructs and outcome measures used to measure the constructs will be tallied. Interventions will be mapped onto the QI they address by listing the articles by the outcomes measured. For example, if a study measures falls as an outcome that article would be listed under the QI “falls”. The articles will be listed under the domains of the existing QIs in Ontario (i.e., wait times, incontinence, activities of daily living, effective cognitive function, pain, emergency department visits, falls, pressure ulcers, restraints, medication safety, human health resources, and infections). If an outcome is reported that does not address one of the current QIs it will be identified and articles reporting this outcome will be listed under the domain of the outcome.

Research question 3 - Tools, models or frameworks for decision-making: A description of the identified tools, models or frameworks for decision-making, the population it has been used with, the country of implementation, and the validation and implementation processes will be displayed and compared in a table.

6. Consultation with stakeholders: We have identified four groups of stakeholders: policy makers, rehabilitation professionals, administrators and health care providers in LTC, and residents and families. During each stage, we will consult the stakeholders via video- or teleconference, surveys or one-on-one consultations to identify questions important for decision-making, to get

input on key messages and definitions of terms or QIs for PR in the LTC sector, and to identify areas for future research. Additionally, we will hold a one-day stakeholder meeting upon completion of the review that will bring together key stakeholders across multiple disciplines, including policy-makers and knowledge users across PR, OT, nursing and kinesiology within the LTC sector. The stakeholder meeting will serve three purposes: 1) to disseminate the results of the scoping review to key stakeholders, and 2) to engage in a formal consensus process using nominal group technique[29,30] to determine which new or existing outcomes and QIs could be used to evaluate PR in LTC, 3) to identify an additional emerging issues and future research priorities for PR in LTC. The scoping review fits into a larger, evolving program of research focused on improving delivery and evaluation of PR in LTC.

ETHICS AND DISSEMINATION

The scoping review will synthesize the characteristics of PR interventions that have been evaluated in LTC, the outcomes and QIs that have been used to evaluate the interventions, and tools or models used to determine eligibility for PR. The review may identify gaps in the literature regarding characteristics of PR interventions, the outcomes used to evaluate them and tools to determine eligibility for services. The review will also be the first step in formally identifying what outcomes and QIs clinicians, policy-makers and researchers can use to evaluate PR in LTC at the person-, facility- and system-level. The

results of the scoping review will be disseminated via publication in health service journals and presentation at conferences specific to PR, LTC and the aging population. Though research ethics board approval will not be required for the scoping review, approval from the University of Waterloo research ethics board will be obtained for the formal consensus process and stakeholders participating in the nominal group technique will complete informed consent to participate. Methods and results of the consensus process will be published in a separate report. The scoping review will not only provide clinicians and policy-makers with knowledge on how to evaluate the impact and quality of PR services in LTC, but will also identify the gaps in knowledge and identify areas for future research for PR in LTC.

CHAPTER 3 – STUDY 1

A scoping review of physical rehabilitation in long-term care: types of interventions, outcomes measured and tools for determining eligibility

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McArthur C, Gibbs JC, Patel R, Papaioannou A, Neves P, Killingbeck J, Hirdes J, Milligan J, Berg K, Giangregorio L. A scoping review of physical rehabilitation in long-term care: types of interventions, outcomes measured and tools for determining eligibility. The Canadian Journal on Aging. 36 (4).

INTRODUCTION

As the aging population increases, many older adults are unable to remain in their own homes and require residential support such as long-term care (LTC). LTC is defined as a home for residents who are unable to live independently, requiring access to nursing, personal care, support and/or supervision.[27] Though variability exists internationally between the definition of and services provided in LTC homes, the acuity and complexity of residents in LTC is a reality worldwide.[31] Residents in LTC are often frail, de-conditioned and often have significant functional impairments increasing the risk for declining health and adverse outcomes.[15,32] Optimization of effective interventions for improving the function of residents in LTC, such as physical rehabilitation (PR)[17], is necessary to prevent the negative sequelae of functional decline.

While evidence suggests that PR can be an effective strategy for improving the function of residents in LTC, uncertainty remains around the delivery of

services. PR encompasses both active (e.g., exercise) and passive (e.g., therapeutic modalities) methods to maintain or improve mobility, physical activity, and overall health and wellness.[4] PR could be delivered by a host of interdisciplinary team members (e.g., physical therapy, occupational therapy, recreation specialists, rehabilitation nursing). A recent systematic review of active PR methods revealed heterogeneity in the literature regarding the model of delivery of, time allocated to, and staff members delivering PR interventions.[17] Additionally, important elements of PR delivery have not been considered in the literature to date, such as the level of PR intervention (i.e., resident, facility, and/or system) and the full scope of active and passive methods. Existing systematic reviews often focus on the efficacy of rehabilitation in a narrowly defined population or setting, a limited scope of PR interventions (e.g., gait training), or lack the clarity necessary to inform implementation. A broad scoping review highlights the characteristics of studies (populations studied, frequency, intensity, time and mode of intervention, professionals delivering it) provides a clearer picture of what we know, what our knowledge gaps are, and will inform implementation and future research.

Evaluation of the effect of PR is crucial to guide clinical decision-making, treatment planning and quality improvement. However, there is inconsistency in the constructs used in the literature and the levels of evaluation remain unclear. An overabundance of resident-level constructs has been used to evaluate PR in LTC.[17] Though resident-level evaluation is important for treatment planning and outcome measurement, evaluation at multiple levels of the healthcare system is

required to promote quality improvement.[13,14] Facility- and system-level evaluation allows for comparison between and within LTC homes and across the greater healthcare system, allowing opportunities for benchmarking and support for quality improvement initiatives.[13,14] The importance of quality indicators to the rehabilitation profession has recently been identified.[33] Quality indicators can be used by both frontline and supervising therapists to guide clinical decision making, evaluate treatment effectiveness, benchmark, report to stakeholders, and implement guideline recommendations.[33] However, the use of constructs other than at the resident-level is not common, therefore an understanding of the outcomes that have been used to evaluate PR in LTC at which levels is necessary to guide future evaluation methods.

Determining eligibility for services is another ambiguous area of PR delivery in LTC that requires attention. Internationally, there are jurisdictional differences in utilisation rates of PR services,[6,8,34] with some studies suggesting exclusion of residents with cognitive impairment.[8,34] Additionally, variation exists across and within countries regarding length of stay and goals of care. In some countries and facilities, residents are admitted to LTC following an acute event with the goal of returning to the community[24,35] while in others, residents are admitted indefinitely.[15] Often the decision around who should receive services is left to the discretion of the therapist or the LTC home. Therefore, it is necessary to provide a synthesis of any tools to assist clinicians in determining who could receive PR services. Consideration should be given to identifying

residents who would benefit from PR in LTC to ensure an equitable and effective use of often scarce services.

The purpose of the current study was to perform a scoping review to inform clinical practice and future research. The objectives were to describe the types of PR evaluated in LTC, the outcomes used to evaluate them, and tools for determining eligibility.[36] Though variability exists in the definition of LTC internationally[31], the purpose of the scoping review was to capture a broad perspective on the PR interventions that have been evaluated to date in residential facilities for medically-complex, frail older adults. The results of a subsequent report will evaluate a third objective - to use the available evidence and stakeholder consultation to determine which new or existing quality indicators could be used to evaluate PR.

METHODS

The methods of the current study have been reported in detail previously.[36] A scoping review was conducted according to the framework proposed by Arksey and O'Malley[25] and the suggestions of Levac et al..[26] The three research questions were: 1) What types of PR have been evaluated for efficacy and effectiveness in LTC? 2) Which outcomes or quality indicators have been used when evaluating the efficacy or effectiveness of PR in LTC? 3) What tools or models exist or have been validated for decision-making in the allocation of PR resources in LTC?

Data sources and searches

Relevant articles were identified in MEDLINE Pubmed (1946 – present), EMBASE Ovid (1974 – present), CINAHL (1981 – present), Cochrane Database of Systematic Reviews (1994 – present), the Physiotherapy Evidence Database (PEDro), and the Occupational Therapy Systematic Evaluation of Evidence database (OTseeker). Databases for this review were chosen to ensure comprehensive coverage of health and medicine journals as well as the specialty journals in rehabilitation. We feel health and medicine are comprehensively covered by including MEDLINE, EMBASE and Cochrane. Specialty journals in rehabilitation are covered in PEDRo and OTseeker. An initial search was run in August 2014, and updated searches were run in April 2015 and December 2016. A structured grey literature search was run in December of 2014 and 2016 in a broad Google search and on the following websites: Canadian Institute for Health Information; Ministry of Health and LTC; National Institutes of Health, and the Government and Legislative Libraries Online Publications Portal; Canadian Physiotherapy Association; Ontario Long-Term Care Association; American Academy of Physical Medicine and Rehabilitation; and the University of Waterloo library catalogue (a full government depository library). The first 100 pages of the Google Search were screened by two team members as per the same protocol employed for the literature review. The key concepts used in the searches were: PR, LTC, interventions that have been evaluated, elderly, decisions regarding resource allocation, tools to assist in decision-making and evaluation including quality indicators.[36] The key concepts were

combined using the Boolean Operator AND, and the search words within each concept were combined with OR. One final search was run in each database as the results for each research question may be applicable to the other research questions.[36]

Study selection

All abstracts were screened by two team members (CM and RP or JCG) and were included based on the following criteria: 1) participants must currently reside in LTC defined as a home for residents who are unable to live independently, requiring access to nursing, personal care, support and/or supervision;[37] 2) a minimum mean or median age as 65 or older; 3) focuses on PR as defined by the Canadian Physiotherapy Association.[4] 4) describes an intervention or a tool for determining eligibility for services that has been validated (i.e., proof of face, construct or criterion validity demonstrated). Case studies, mixed methods, prospective, longitudinal, retrospective case-control, randomized controlled trials, quasi-randomized clinical trials or controlled trials, clinical practice guidelines, systematic reviews, and relevant reports generated by policy makers were included. Articles were excluded if they discussed an invalidated tool, were non-English full texts, clinical commentaries, editorials, interviews, legal cases, letters, newspaper articles, patient education handouts, abstracts or unpublished literature.

Data extraction and quality assessment

Data were extracted and charted in duplicate by two team members (CM and RP or JCG) using a pilot-tested data extraction form. Data extracted from the

articles included: title, authors, location (country), research question addressed (1, 2 and/or 3), type of literature (e.g., peer-reviewed paper, policy report), length of stay of residents (short-stay: less than 90 days, long-stay: greater than or equal to 90 days), description of participants (age, sex, inclusion/exclusion criteria), description of facility (e.g., nursing home, long-term care), study design (e.g., randomized controlled trial, cohort study), description of intervention (therapeutic goals/type, frequency, time/volume, duration, who delivered, level of intervention – (resident, facility, system), quality indicator addressed, outcome of interest, construct measured, outcome measure used, outcome level (resident, facility, system), name and description of tool for decision-making, population of tool for decision making, country of implementation, and description of validation process for tool.[36] The target of the intervention was used to describe the intervention, and if there was more than one target it was classified as a "multi-target exercise program". For example, if the target of the intervention was to improve balance it was classified as "balance", but if the target was to improve balance and strength it was classified as "multi-target exercise program". Though studies were not formally assessed for quality (e.g., blinding of assessors, randomization), the study design was extracted and reported as a proxy measure of quality.

Data synthesis and analysis

The results were presented as described in the protocol for the current review.[36] After completing data extraction and analysis, preliminary results of the scoping review were presented to a group of stakeholders with expertise in rehabilitation

and LTC at a half day meeting. Stakeholders were initially recruited at the commencement of the study by the first author to ensure the research questions were relevant to the LTC sector and rehabilitation professionals. Stakeholders were then asked at the half day meeting if there was any additional information they would like to know about the studies included. The stakeholders were not involved in any of the data extraction or analysis. The group of 14 stakeholders included clinicians working in LTC (physical therapist, occupational therapist, nurse, physician and kinesiologist), researchers, administrators and policy-makers. The stakeholders deemed it important to include a detailed description of the participants included in the articles, so this was added. Specifically, a description of functional status, cognition and acuity was added to the summary of articles included. Next, interventions were sorted and described under the domain of the quality indicator (QI) they address. For example, if the article reported activities of daily living (ADLs) as an outcome, that article is described under the domain of "ADLs". Twelve a priori domains were chosen based on the QIs that are currently publicly reported in Ontario (wait times, incontinence, ADLs, cognitive function, pain, emergency department visits, falls, pressure ulcers, restraints, medication safety, human health resource, infections).[20] If articles reported domains of outcomes other than the aforementioned, those articles were grouped together and presented under the other domains. Articles could be included under more than one domain if they reported outcomes across several domains. Articles reporting different results from the same study population were not grouped. Under each domain, interventions were then

further grouped based on the level of intervention delivery (resident, facility or system). Resident-level interventions were those that involved directly delivering services to the resident (e.g., an exercise class). Facility-level interventions had an element of involving the facility or were interventions delivered by the entire facility (e.g., education to staff, environmental changes, facility policies). Interventions at the system-level had to involve changes external to the facility that instilled change across multiple homes (e.g., changes to regional or national funding policies, PR teams working across the system such as outreach teams). If interventions were delivered at more than one level, they were categorized by the level of delivery of the main component of the intervention. Intervention details were then described at the level of the main component. Finally, the frequency at which constructs and outcome measures were reported was tallied at the resident-, facility- and system-level, and expressed as a percentage of the total number of times that the domain was measured at that level.

RESULTS

Description of studies and resident characteristics

381 articles and 2 reports were included in the scoping review (Figure 1, Appendix 2 and 3).

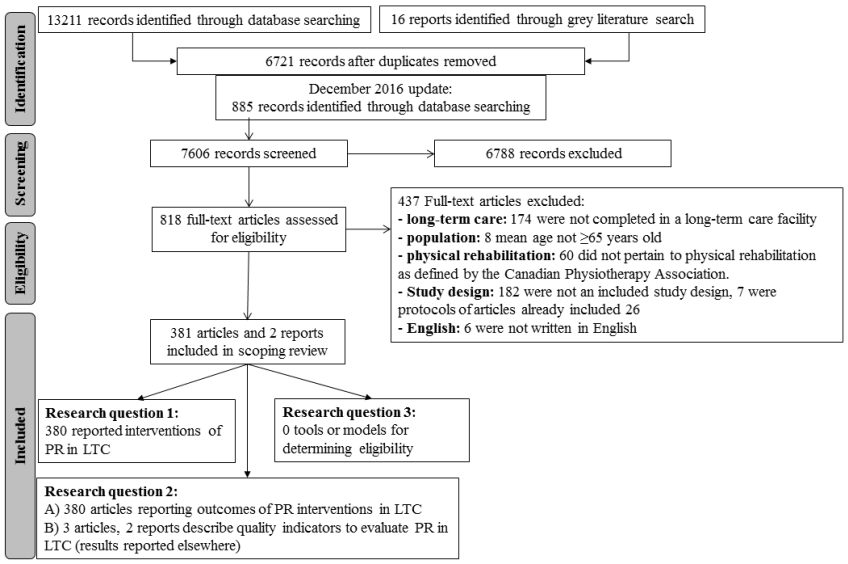

Figure 1. Flow of articles through the scoping review

The United States had the largest number of articles (25.0%, Figure 2). Most of the articles did not report the length of stay of residents (61.4%) and only 3.9 per cent of publications explicitly included short-stay residents (Table 3, Figure 2). The mean age of included residents was 81.9 ± 5.0 years and the majority were female (71.4%) (Table 3). Functional status was not mentioned in the inclusion and exclusion criteria of half (49.9%) of the articles, but one quarter of studies (23.4%) required residents to be ambulatory with or without an assistive device (Table 3). Very few articles specifically included residents who were non-ambulatory (7.6%) or bedridden (0.6%). Additionally, only 16.3 per cent of the articles included residents with evidence of a diagnosis of dementia (Table 3). Finally, medical acuity was not an inclusion or exclusion criterion for most of the studies. However, 27.3 per cent explicitly stated that only residents who were not medically acute were included (Table 3).

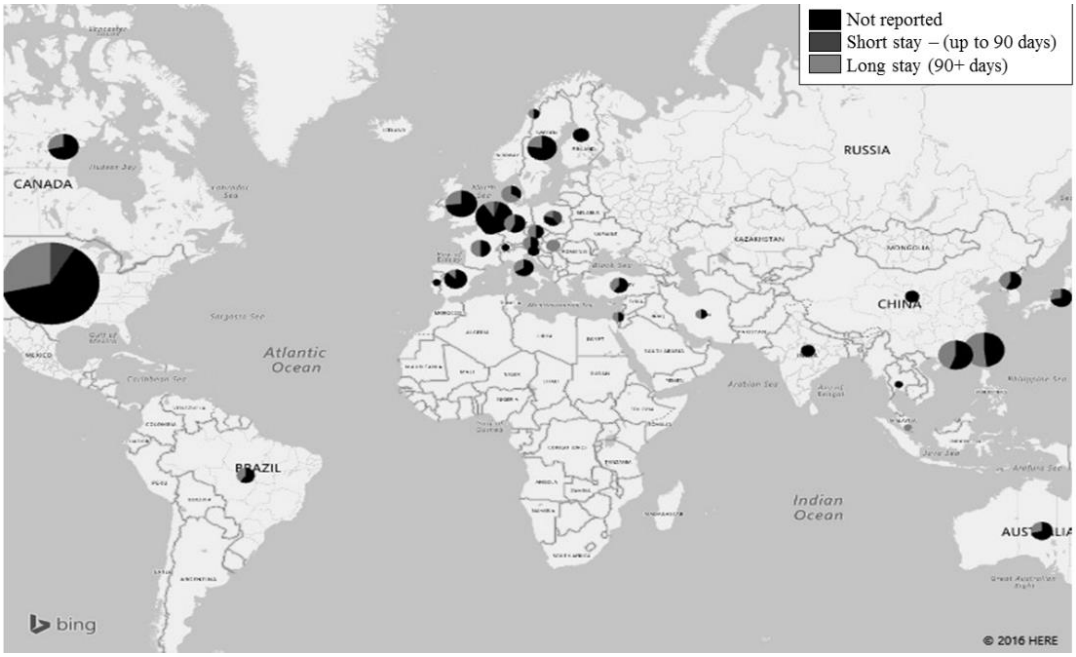

Figure 2a. Map of included articles, demonstrating proportions of length of stay

Note: The size of the circle represents the number of articles originating from that country. The pie chart within the dot represents to proportion of the articles that included residents that were short-stay (participants resided in the LTC home for up to 90 days), long-stay (90 days or more), or if the length of stay was not reported. Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.

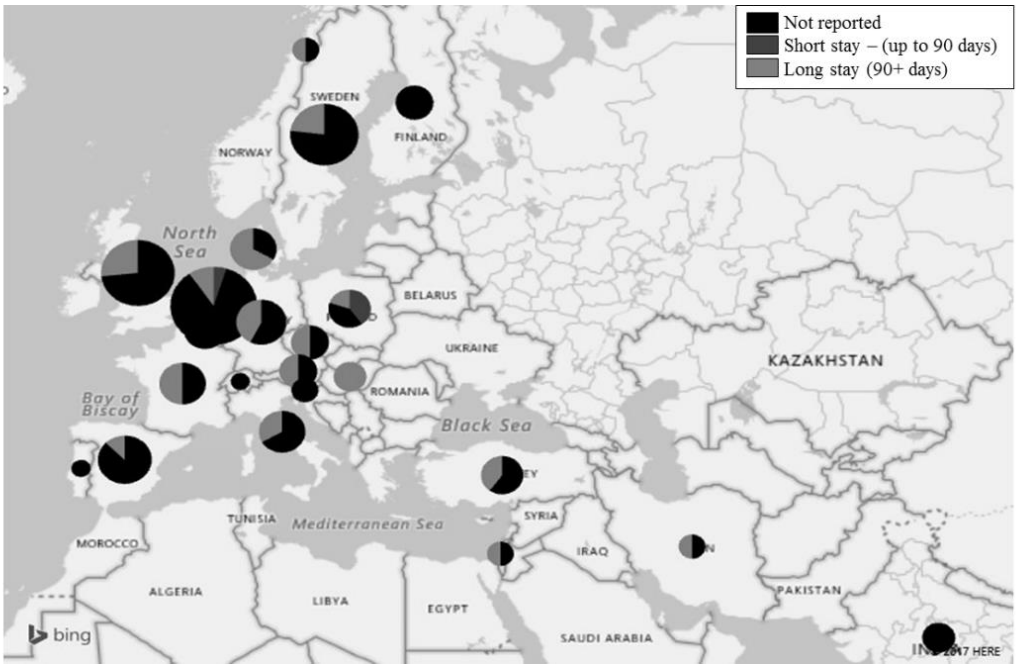

Figure 2b. Map of included articles (zoom in on Europe), demonstrating proportions of length of stay

Note: The size of the circle represents the number of articles originating from that country. The pie chart within the dot represents to proportion of the articles that included residents that were short-stay (participants resided in the LTC home for up to 90 days), long-stay (90 days or more), or if the length of stay was not reported. Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.

Table 3. Description of participants included in articles

Characteristic		**%**	**Response frequency (n)**
Mean age (standard deviation)	81.9 (5.0)		
Sex, % female	71.4		
Length of stay, % (n)			
Short stay (up to 90 days)		3.9	15
Long stay (90+ days)		29.1	111
Not reported		61.4	234
Functional status			
Included only residents who are able to walk, with or without a gait aid		23.4	89
Included non-ambulatory and ambulatory residents		7.6	29
Included residents who are bedridden		0.5	2
Functional status not an inclusion/exclusion criteria		49.9	190
Other (a combination of above descriptors, or alternative wording)		13.1	50
Cognitive status (e.g., ability to follow directions, diagnosis of dementia, score on measure of cognition such as Mini-mental state exam)			
Included only residents with little or no cognitive impairment		23.4	89
Included residents with evidence of cognitive impairment and/or diagnosis of dementia or Alzheimer's disease		16.3	62
Included residents who were "able to follow directions"		13.9	53
Cognitive status not an inclusion/exclusion criteria		31.7	121

Other (a combination of above descriptors, or alternative wording)	9.2	35
Medical acuity (e.g., resident's health stability)		
Included only residents who were not medically acute	27.3	104
Included residents regardless of medical acuity	1.6	6
Medical acuity not an inclusion/exclusion criteria	60.1	229
Other	5.5	21
Description of facility (name used in article)		
Nursing home	50.0	180
Long-term care	14.7	53
Residential care facility	10.8	39
Skilled nursing facility	9.4	34
Assisted living	6.4	23
Care home	3.1	11
Old age home	1.9	7
Other	3.6	13

Research question 1 and 2: Description of interventions and outcomes

The included articles mapped onto the a priori and other domains, the level of evidence based on study design, and the level of intervention delivery is found in Figure 3.

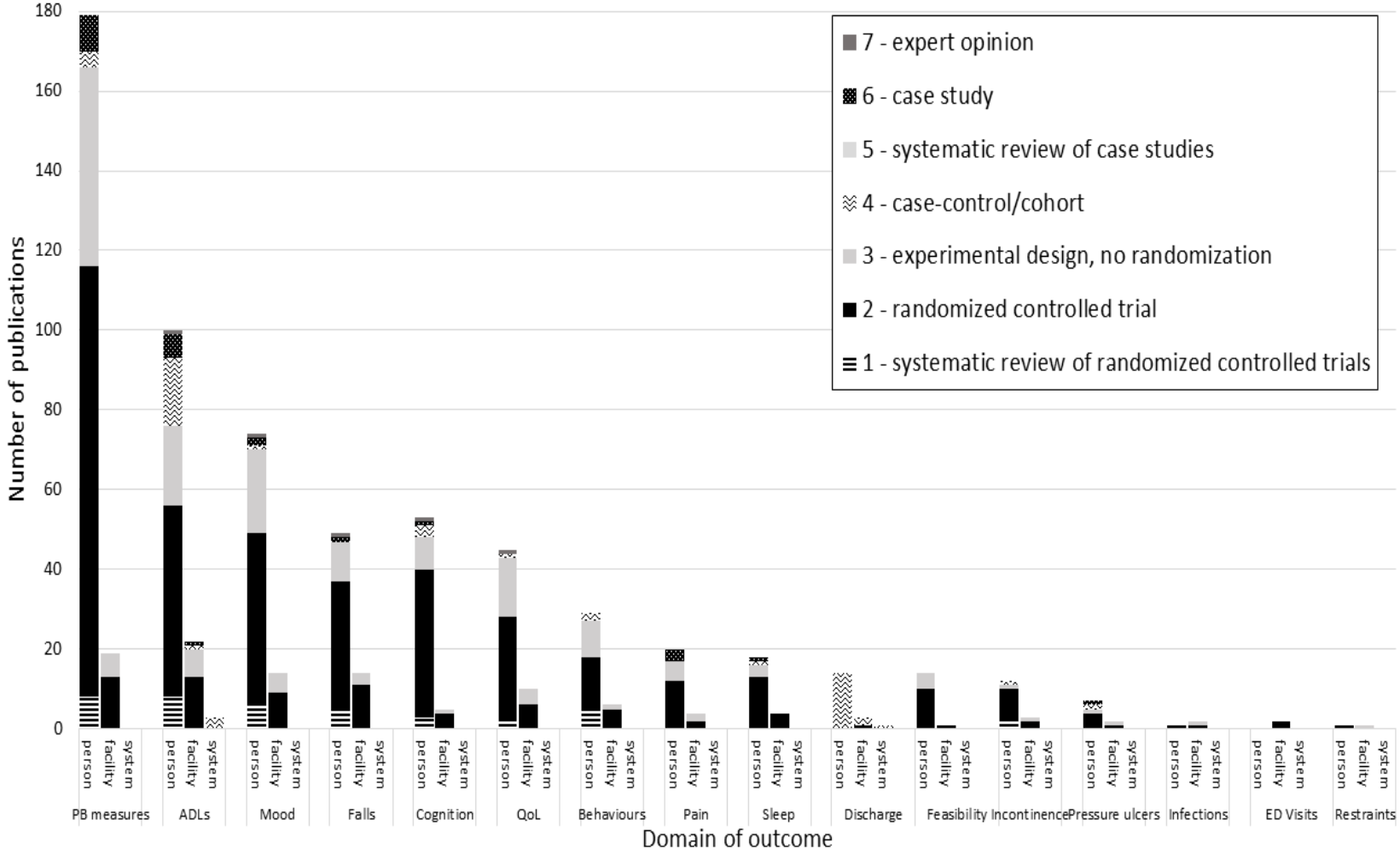

Figure 3. Number of articles and level of evidence per domain of outcome at the resident-, facility- and system-level

Of the included articles, 332 described resident-level, 44 described facility-level and 4 described system-level interventions. At all three levels of PR delivery, components of the intervention were often not reported with percent of articles per domain not reporting a component ranging from 0-100 per cent (Table 4). The other domains identified were: performance based measures (e.g., Timed-up-and-Go and the Berg Balance Scale), mood, quality of life, responsive behaviours, sleep, discharge, and feasibility. Feasibility was defined as the ease of delivering the PR intervention, with constructs measured including recruitment, retention, and adherence (Table 4). Performance-based measures were the most frequently reported outcomes for resident-level PR delivery (n=180), followed by ADLs (n=100) and mood (n=74) (Figure 3). For facility-level PR delivery, the ADLs (n=22), performance-based measures (n=198), falls (n=14) and mood (n=14) domains were the most frequently reported. ADLs (n=3) and discharge (n=1) were the only reported outcome domains for system-level PR interventions.

At the resident-level, interventions were delivered on average 2.8 to 4.7 days per week for 25.0 to 46.1 minutes per session over a period of 10.5 to 18.4 weeks (Table 4). Results for outcome domains with less than 10 articles are reported in Appendix 4. The most frequently reported type of intervention across all domains was multi-target exercise program, except for the discharge domain where individualized rehab was the most frequent program (Table 4). The type of professional delivering the interventions varied across all domains. However, research staff was most frequently reported for six of the a priori

domains (falls, cognition, incontinence, pressure ulcers, infections and restraints) and three of the other domains (responsive behaviours, mood, and sleep) (Table 4). Interventions were delivered most often in a group setting, except for the domains of pain, incontinence, and sleep where they were delivered most often on an individual basis, or restraints and discharge where it was not reported how they were delivered (Table 4).

Facility-level interventions were delivered on average1.3 to 5.0 days per week, for 23.3 to 60.0 minutes per session, over a period of 5.6 to 104.0 weeks (Table 4). Like resident-level interventions, facility-level interventions most often involved multi-target group exercise programs, except for ADLs and discharge domains which were frequently not reported (Table 4). Nursing staff and physical therapists most often delivered the interventions at the facility level, in contrast to the resident-level where most were delivered by research staff.

System-level interventions were far less common (n=4). Frequency, time or length of the delivery were not reported for any of the articles describing system-level interventions. These articles often stated that residents received physical rehabilitation but provided no descriptors. All four articles described individualized rehab professional programs, with two reporting delivery by interprofessional rehab staff and two not reporting who delivered the intervention. One article reported that the intervention was delivered on an individual basis, while the other three did not report how the intervention was delivered.

Table 4. Description of person- and facility-level physical rehabilitation interventions presented by domain evaluated

	a priori domains									
Domain of outcome	**ADLs**		**Falls**		**Cognition**		**Pain**		**Incontinence**	
Level of intervention	**Person**	**Facility**	**Person**	**Facility**	**Person**	**Facility**	**Person**	**Facility**	**Person**	**Facility**
Number of articles	**n=100**	**n=22**	**n=48**	**n=14**	**n=53**	**n=5**	**n=20**	**n=4**	**n=12**	**n=3**
Description of intervention										
Mean frequency, days/week	3.2	2.3	3.9	2.8	3.3	2.5	3.0	1.3	4.7	2.0
(range)	(1-6)	(1-3)	(1-7)	(2-7)	(1-7)	(2-3)	(1-6)	(1-2)	(1-7)	(2-2)
% articles not reporting	24.0	77.3	10.4	50.0	15.1	60.0	5.0	25.0	40.0	66.7
Mean time per visit, minutes	43.3	41.5	34.9	43.8	42.6	45	33.9	55.0	25.0	60.0
(range)	(3.4-150)	(20-60)	(1-60)	(20-60)	(15-90)	(45-45)	(9-60)	(45-60)	(5-40)	(60-60)
% articles not reporting	30.0	96.4	20.8	64.3	11.3	80.0	25.0	25.00	41.7	66.7
Mean length of intervention, weeks	17.1	33.9	17.2	33.5	16.6	41.2	10.5	21.5	18.4	28.0
(range)	(2.7-60)	(4-108)	(3.5-52)	(11-54)	(0.14-60)	(24-52)	(1-32)	(18-52)	(6-32)	(4-52)
% articles not reporting	21.0	31.8	4.2	0	9.4	0	0	0	8.3	33.3
Type										
Strength only	9.0 (9)	-	10.4 (5)	14.3 (2)	9.4 (5)	-	10.0 (2)	-	8.3 (1)	33.3 (1)
Balance only	1.0 (1)	-	12.5 (6)	7.1 (1)	1.9 (1)	-	-	-	-	-
Aerobic only	1.0 (1)	-	2.1 (1)	-	7.5 (4)	-	10.0 (2)	-	-	-
Flexibility/Range of motion only	3.0 (3)	-	-	-	-	-	10.0 (2)	-	-	-
Recreational activities only	2.0 (2)	4.5 (1)	2.1 (1)	7.1 (1)	-	-	-	-	-	-
Walking/ambulation only	2.0 (2)	-	-	-	1.9 (1)	-	-	-	-	-
Restorative/rehabilitative nursing	3.0 (3)	40.9 (9)	4.2 (2)	14.3 (2)	-	20.0 (1)	5.0 (1)	25.0 (1)	8.3 (1)	-
Passive modality – laser, etc.	2.0 (2)	-	4.2 (2)	-	-	-	15.0 (3)	-	-	-
Yoga, tai chi, dancing, etc.	3.0 (3)	-	6.25 (3)	-	9.4 (5)	-	15.0 (3)	-	-	-
Functional skills training	3.0 (3)	9.1 (2)	2.1 (1)	7.1 (1)	3.8 (2)	20.0 (1)	-	-	8.3 (1)	-
Multi-target exercise program	40.0 (40)	27.3 (6)	39.6 (19)	50 (7)	41.5 (22)	40.0 (2)	25.0 (5)	75.0 (3)	50.0 (6)	33.3 (1)
Individualized rehab program	21.0 (21)	18.2 (4)	6.25 (3)	21.4 (3)	13.2 (7)	-	-	-	8.3 (1)	33.3 (1)
Other	3.0 (3)	-	4.2 (2)	-	3.8 (2)	20.0 (1)	15.0 (3)	-	-	-
Unclear or not reported	4.0 (4)	13.6 (3)	4.2 (2)	-	4.3 (3)	-	15.0 (3)	-	16.6 (2)	-

Table 4 (continued). Description of person- and facility-level physical rehabilitation interventions presented by domain evaluated

Domain of outcome	Other domains									
	Performance-based measures		Mood		Quality of life		Responsive behaviours		Sleep	
Level of intervention	**person**	**facility**	**person**	**facility**	**person**	**facility**	**person**	**facility**	**person**	**facility**
Number of articles	**n=180**	**n=19**	**n=74**	**n=14**	**n=45**	**n=10**	**n=29**	**n=6**	**n=18**	**n=4**
Description of intervention										
Mean frequency, days/week	3.1	3.0	3.1	2.4	2.8	2.8	3.4	5.0	4.5	4.5
(range)	(1-7)	(1-7)	(1-6)	(1-7)	(1-7)	(1-7)	(1-7)	(3-7)	(2-7)	(3-7)
% articles not reporting	3.3	42.1	9.5	42.9	6.7	60.0	13.8	30.0	11.1	0
Mean time per visit, minutes	38.0	40.0	40.1	45.8	46.1	55	34.7	30	35.0	23.3
(range)	(1-180)	(20-60)	(5-70)	(20-60)	(5-180)	(45-60)	(5-60)	(30-30)	(3-70)	(10-30)
% articles not reporting	13.9	68.4	6.8	64.3	11.1	70.0	10.3	50.0	16.7	25.0
Mean length of intervention, weeks	14.3	32.8	15.5	29.3	16.2	30.4	17.1	15.1	14.9	5.6
(range)	(2-54)	(8-54)	(1-60)	(8-52)	(4-52)	(8-52)	(2-60)	(2.5-30)	(0.29-52)	(1-14)
% articles not reporting	3.9	10.5	5.4	21.4	6.7	30.0	6.9	16.7	5.6	0
Type										
Strength only	10.0 (18)	11.1 (2)	6.8 (5)	-	13.3 (6)	-	3.4 (1)	-	5.6 (1)	-
Balance only	5.6 (10)	5.6 (1)	-	-	4.4 (2)	-	-	-	-	-
Aerobic only	4.4 (8)	-	2.7 (2)	-	-	-	-	-	-	-
Flexibility/Range of motion only	4.4 (8)	-	2.7 (2)	-	-	-	-	-	-	-
Recreational activities only	1.1 (2)	-	-	-	4.4 (2)	-	-	-	-	-
Walking/ambulation only	2.2 (4)	-	-	-	-	-	-	-	5.6 (1)	-
Restorative/rehabilitative nursing	1.1 (2)	27.8 (5)	4.1 (3)	14.3 (2)	-	40.0 (4)	-	33.3 (2)	-	-
Passive modality – laser, etc.	2.2 (4)	-	5.4 (4)	-	-	-	6.9 (2)	-	16.7 (3)	-
Yoga, tai chi, dancing, etc.	9.4 (17)	5.6 (1)	14.9 (11)	-	26.7 (12)	-	6.9 (2)	-	33.3 (6)	-
Functional skills training	2.2 (4)	16.7 (3)	2.7 (2)	21.4 (3)	6.7 (3)	10.0 (1)	3.4 (1)	16.7 (1)	-	-
Multi-target exercise program	48.3 (87)	44.4 (8)	39.2 (29)	50.0 (7)	40.0 (18)	30.0 (3)	34.5 (10)	50.0 (3)	33.3 (6)	75.0 (3)
Individualized rehab program	3.3 (6)	11.1 (2)	6.8 (5)	14.3 (2)	2.2 (1)	10.0 (1)	3.4 (1)	-	-	-
Other	2.8 (5)	-	6.8 (5)	-	4.4 (2)	10.0 (1)	24.1 (7)	-	5.6 (1)	25.0 (1)
Unclear or not reported	2.8 (5)	-	8.2 (6)	7.1 (1)	4.4 (2)	-	24.1 (7)	-	5.6 (1)	-

Table 4 (continued). Description of person- and facility-level physical rehabilitation interventions presented by domain evaluated

	Other domains			
Domain of outcome	**Discharge**		**Feasibility**	
Level of intervention	**Person**	**facility**	**person**	**facility**
Number of articles	**n=14**	**n=3**	**n=14**	**n=0**
Description of intervention				
Mean frequency, days/week (range)	not reported	not reported	3.1 (2-5)	-
% articles not reporting	100	100	7.1	-
Mean time per visit, minutes (range)	not reported	not reported	36.7 (20-60)	-
% articles not reporting	100	100	7.1	-
Mean length of intervention, weeks (range)	not reported	40.5 (40.5-40.5)	10.5 (1-25)	-
% articles not reporting	100	66.7	0	-
Type				
Strength only	-	-	14.3 (2)	-
Balance only	-	-	-	-
Aerobic only	-	-	7.1 (1)	-
Flexibility/Range of motion only	-	-	-	-
Recreational activities only	-	-	-	-
Walking/ambulation only	-	-	-	-
Restorative/rehabilitative nursing	-	-	-	-
Passive modality – laser, etc.	-	-	7.1 (1)	-
Yoga, tai chi, dancing, etc.	-	-	7.1 (1)	-
Functional skills training	-	-	7.1 (1)	-
Multi-target exercise program	-	-	50.0 (7)	-
Individualized rehab program	92.9 (13)	66.7 (2)	7.1 (1)	-
Other	-	-	-	-
Unclear or not reported	7.1 (1)	33.3 (2)	-	-

Table 4 (continued). Description of person- and facility-level physical rehabilitation interventions presented by domain evaluated

	a priori domains									
Domain of outcome	**ADLs**		**Falls**		**Cognition**		**Pain**		**Incontinence**	
Level of intervention	**Person**	**Facility**	**Person**	**Facility**	**Person**	**Facility**	**Person**	**Facility**	**Person**	**Facility**
Number of articles	**n=100**	**n=22**	**n=48**	**n=14**	**n=53**	**n=5**	**n=20**	**n=4**	**n=12**	**n=3**
Description of intervention (continued)										
Profession delivering										
Physical therapist	21.0 (21)	18.2 (4)	16.7 (8)	35.7 (5)	13.2 (7)	20.0 (1)	10.0 (2)	75.0 (3)	8.3 (1)	66.7 (2)
Occupational therapist	2.0 (2)	9.1 (2)	-	-	1.9 (1)	-	-	-	-	-
Nursing	6.0 (6)	40.9 (9)	10.4 (5)	28.6 (4)	3.8 (2)	20.0 (1)	20.0 (4)	25.0 (1)	8.3 (1)	33.3 (1)
Recreation staff	2.0 (2)	9.1 (2)	2.1 (1)	7.1 (1)	1.9 (1)	-	-	-	-	-
PTA or OTA only	2.0 (2)	4.5 (1)	-	7.1 (1)	1.9 (1)	-	-	-	-	-
Fitness/yoga/tai chi instructor	8.0 (8)	-	8.3 (4)	-	17.0 (9)	-	10.0 (2)	-	-	-
Exercise physiologist	1.0 (1)	4.5 (1)	2.1 (1)	7.1 (1)	1.9 (1)	20.0 (1)	-	-	-	-
Interdisciplinary rehabilitation staff	25.0 (25)	18.2 (4)	8.3 (4)	-	13.2 (7)	40.0 (2)	5.0 (1)	-	16.6 (2)	-
Kinesiologist	1.0 (1)	-	-	-	1.9 (1)	-	-	-	-	-
Research staff	11.0 (11)	-	22.9 (11)	-	22.6 (12)	-	20.0 (4)	-	50.0 (6)	-
Other	4.0 (4)	-	2.1 (1)	-	5.7 (3)	-	5.0 (1)	-	-	-
Unclear or not reported	14.0 (14)	9.1 (2)	20.7 (10)	35.7 (5)	13.1 (7)	-	35.0 (7)	-	16.6 (2)	-
Format of delivery										
Group only	42.0 (42)	22.7 (5)	39.6 (19)	50 (7)	77.8 (28)	40.0 (2)	35.0 (7)	75.0 (3)	26.6 (2)	33.3 (1)
Individual only	28.0 (28)	22.7 (5)	27.1 (13)	42.9 (6)	44.4 (16)	-	65.0 (13)	25.0 (1)	41.7 (5)	33.3 (1)
Group and individual	2.0 (2)	22.7 (5)	6.25 (3)	7.1 (1)	-	40.0 (2)	-	-	8.3 (1)	-
Unclear or not reported	22.0 (22)	49.1 (11)	18.7 (9)	7.7 (3)	19.3 (7)	20.0 (1)	5.0 (1)	-	33.2 (4)	33.3 (1)

ADLs=activities of daily living; PTA=physical therapy assistant; OTA=occupational therapy assistant

Table 4 (continued). Description of person- and facility-level physical rehabilitation interventions presented by domain evaluated

Domain of outcome	Other domains									
	Performance-based measures		Mood		Quality of life		Responsive behaviours		Sleep	
Level of intervention	person	facility	person	facility	person	facility	person	facility	person	facility
Number of articles	n=180	n=19	n=74	n=14	n=45	n=10	n=29	n=6	n=18	n=4
Description of intervention (continued)										
Profession delivering										
Physical therapist	22.2 (40)	22.2 (4)	16.2 (12)	28.6 (4)	24.4 (11)	30.0 (3)	3.4 (1)	-	-	-
Occupational therapist	1.1 (2)	-	4.1 (3)	7.1 (1)	2.2 (1)	10.0 (1)	3.4 (1)	-	-	-
Nursing	2.2 (4)	50.0 (9)	9.5 (7)	28.6 (4)	4.4 (2)	50.0 (5)	-	33.3 (2)	11.1 (2)	-
Recreation staff	2.2 (4)	5.6 (1)	1.4 (1)	7.1 (1)	-	-	3.4 (1)	-	-	-
PTA or OTA only	1.1 (2)	5.6 (1)	1.4 (1)	-	-	-	3.4 (1)	-	-	-
Fitness/yoga/tai chi instructor	16.1 (29)	-	18.9 (14)	-	24.4 (11)	-	10.3 (3)	-	22.2 (4)	-
Exercise physiologist	2.2 (4)	11.1 (2)	4.1 (3)	7.1 (1)	-	-	3.4 (1)	-	-	-
Interdisciplinary rehabilitation staff	7.8 (14)	11.1 (2)	8.1 (6)	21.4 (3)	6.7 (3)	10.0 (1)	6.9 (2)	16.7 (1)	-	-
Kinesiologist	0.6 (1)	-	-	-	-	-	-	-	-	-
Research staff	21.1 (38)	-	20.3 (15)	-	24.4 (11)	-	17.2 (5)	50.0 (3)	38.9 (7)	100.0 (4)
Other	2.2 (4)	-	5.4 (4)	-	4.4 (2)	-	13.8 (4)	-	5.6 (1)	-
Unclear or not reported	21.6 (39)	16.7 (3)	8.1 (6)	-	13.3 (6)	-	20.6 (6)	-	22.2 (4)	-
Format of delivery										
Group only	35.6 (82)	55.6 (10)	54.1 (40)	50.0 (7)	66.7 (30)	30.0 (3)	41.4 (12)	16.7 (1)	33.3 (6)	50.0 (2)
Individual only	35.0 (63)	33.3 (6)	25.7 (19)	28.6 (4)	20.0 (9)	30.0 (3)	24.1 (7)	33.3 (2)	38.9 (7)	50.0 (2)
Group and individual	2.2 (4)	22.2 (4)	4.1 (3)	14.3 (2)	2.2 (1)	10.0 (1)	3.4 (1)	33.3 (2)	-	-
Unclear or not reported	18.2 (33)	16.7 (3)	10.8 (8)	21.4 (3)	13.3 (6)	30.0 (3)	17.2 (5)	20.0 (1)	27.7 (5)	-

PTA=physical therapy assistant; OTA=occupational therapy assistant

Table 4 (continued). Description of person- and facility-level physical rehabilitation interventions presented by domain evaluated

Domain of outcome	Other domains (continued)			
	Discharge		Feasibility	
Level of intervention	Person	facility	person	facility
Number of articles	n=14	n=3	n=14	n=0
Description of intervention (continued)				
Profession delivering				
Physical therapist	7.1 (1)	33.3 (1)	21.4 (3)	-
Occupational therapist	-	-	-	
Nursing	-	-	-	-
Recreation staff	-	-	-	-
PTA or OTA only	-	-	-	-
Fitness/yoga/tai chi instructor	-	-	28.6 (4)	-
Exercise physiologist	-	-	-	-
Interdisciplinary rehabilitation staff	85.7 (12)	33.3 (1)	7.1 (1)	-
Kinesiologist	-	-	7.1 (1)	-
Research staff	-	-	7.1 (1)	-
Other	-	-	-	-
Unclear or not reported	14.3 (2)	33.3 (1)	28.5 (4)	-
Format of delivery				
Group only	-	-	42.9 (6)	-
Individual only	14.3 (2)	-	42.9 (6)	-
Group and individual	-	-	7.1 (1)	-
Unclear or not reported	85.7 (12)	100 (3)	7.1 (1)	-

PTA=physical therapy assistant; OTA=occupational therapy assistant

The vast majority of outcomes were measured at the resident-level, with the most common measures being a dynamometer, the Timed-up-and-go, walking tests (e.g., 10 metre walk), chair stand tests (e.g., 30 second sit to stand), the Geriatric Depression Scale, the Barthel Index, the Mini-Mental State Exam, and the Functional Independence Measure (Table 5). At the facility-level, the only constructs that were measured were ADLs, falls, urinary incontinence, pressure ulcers, restraints, locomotion ability and discharge (Table 5). System-level outcomes were measured in 11 articles. Number and duration of hospitalization episodes, cost and labour of service provision, discharge location, survival time, and process outcomes (e.g., number of referrals, reason for referrals) were the constructs measured at the system-level.

Research question 3: Tools or models for determining eligibility for services

Though two articles[38,39] were identified as reporting a model for determining eligibility for PR services in LTC, neither article provided evidence of validation (i.e., proof of face, construct or criterion validity demonstrated) and therefore were not included in the current review.

Table 5. Constructs and outcome measures used presented by the level of evaluation

		Level of outcome, measures used			
Domain	**Constructs measured**	**Person**	**n (%)**	**Facility**	**n (%)**
ADLs	Activities of daily living	*n=144*		*n=2*	
	Functional independence (e.g., level of assistance required to perform functional tasks)	Barthel Index	35.4 (51)	RAI-MDS ADL quality indicator	50 (1)
		Functional independence measure	13.2 (19)	Functional independence measure	50 (1)
		Katz Index	5.6 (8)		
	Functional mobility	RAI-MDS† ADL* scale	5.6 (8)		
	% achieved functional independence	Rivermead	4.9 (7)		
		Physical Disability index	1.4 (2)		
		Nursing home physical performance test	1.4 (2)		
		Other	32.6 (47)		
Falls	# of falls	*n=48*		*n=3*	
	# of injurious falls	Chart review/incident report	31.3 (15)	Chart review/incident report	100 (3)
	Falls rate	Falls efficacy scale	37.5 (18)		
	% of residents falling	Fear of falling questionnaire	8.3 (4)		
	Falls risk	Other	8.3 (4)		
	Falls efficacy	Not reported	35.4 (17)		
	Fear of falling				
Cognition	Cognitive function	*n=99*		*n=0*	
	Executive function	Mini-mental state exam	33.3 (33)		
	Memory	Other	34.3 (33)		
		Verbal, word, letter or category fluency	8.1 (8)		
		Wechsler memory scale	6.1 (6)		
		Rivermead behavioural memory test	5.1 (5)		
		Eight word recall	5.1 (5)		
		Stroop test	5.1 (5)		
		Functional independence measure	2.0 (2)		
		Picture completion test	2.0 (2)		
		Symbol digit task	2.0 (2)		

ADLs=activities of daily living; RAI-MDS=resident assessment instrument – minimum data set; n=number of times outcome was used

Table 5. (continued) Constructs and outcome measures used presented by the level of evaluation

		Level of outcome, measures used			
Domain	**Constructs measured**	**Person**	**n (%)**	**Facility**	**n (%)**
Pain	Pain intensity	*n=28*		*n=0*	
	Pain location	Other	42.9 (12)		
	Discomfort	Numeric pain rating scale	25.0 (7)		
		Verbal rating score	14.3 (4)		
		Geriatric pain measure	10.7 (3)		
		Visual analog scale	7.1 (2)		
Incontinence	Incontinence status	*n=19*		*n=2*	
	Incontinence frequency	Observation	42.1 (8)	RAI-MDS unplanned urinary	50.0 (1)
	Urgency	Daily urinary forms	21.1 (4)	catheter placement quality indicator	
	Nocturia	Self-report	15.8 (3)	RAI-MDS incontinence quality indicator	50.0 (1)
	Toileting ratio	Other	15.8 (3)		
	% of checks incontinent	Pad wetting test	10.5 (2)		
Pressure ulcers	Presence of pressure ulcers	*n=19*		*n=2*	
	Appearance of wounds	Observation	47.4 (9)	RAI-MDS pressure ulcer quality indicator	100 (2)
	Wound surface area	Photograph or tracing	15.8 (3)		
	Wound volume	Other	36.8 (7)		
	Healing rate				
	Risk of pressure ulcer				
Infections	Incidence of urinary tract infections	*n=3*		*n=0*	
	Incidence of pneumonia, acute bronchitis	Chart review	100 (3)		
Restraints	Type of restraint used	*n=1*		*n=4*	
	% residents with restraints	Chart review	100 (1)	Chart review	100 (4)
	Reason for restraint use				
	Types of restraint reduction interventions				

RAI-MDS=resident assessment instrument – minimum data set; n=number of times outcome was used

Table 5. (continued) Constructs and outcome measures used presented by the level of evaluation

		Level of outcome, measures used			
Domain	**Constructs measured**	**Person**	**n (%)**	**Facility**	**n (%)**
		n=580		*n=2*	
Performance based measures	Functional mobility	Other	14.7 (85)	Walking test	50 (1)
	Functional balance	Dynamometer, mechanical force	12.0 (61)	Functional independence Measure - locomotion component	50 (1)
	Balance	Timed up and go	10.3 (60)		
	Strength	Walking tests (e.g., 10 metre walk)	9.3 (54)		
	Grip strength	Chair stand tests (e.g., 30 second sit to stand	8.1 (47)		
	Flexibility	Six-minute walk test	6.2 (36)		
	Range of motion	Not reported	5.5 (32)		
	Endurance	Berg Balance Scale	5.0 (29)		
	Physical performance	Tinetti Performance	4.3 (25)		
	Ability to climb stairs	Single leg stance test	3.8 (22)		
	Postural sway	Sit and reach test	3.3 (19)		
	Coordination	Goniometry	3.3 (19)		
		Functional reach test	2.4 (14)		
		1 repetition maximum	1.6 (9)		
		Progressive balance tests	1.6 (9)		
		Manual muscle testing	1.4 (8)		
		Back scratch test	1.4 (8)		
		Short Physical Performance Battery	1.4 (8)		
		Elderly mobility scale	0.9 (5)		
		2-minute step test	0.7 (4)		
		Arm curl test	0.7 (4)		
		Seniors' fitness test	0.3 (2)		
		Physical performance test	0.3 (2)		

n=number of times outcome was used

Table 5. (continued) Constructs and outcome measures used presented by the level of evaluation

		Level of outcome, measures used			
Domain	**Constructs measured**	**Person**	**n (%)**	**Facility**	**n (%)**
Mood	Depression	*n=98*		*n=0*	
	Anxiety	Geriatric depression scale	43.9 (43)		
	Morale	Other	25.5 (25)		
	Affect	Cornell scale of depression in dementia	9.2 (9)		
	Loneliness	Philadelphia Geriatric Centre Morale scale	7.1 (7)		
	Happiness	Hospital Anxiety and depression scale	3.1 (3)		
		Tawainese depression questionnaire	3.1 (3)		
		Observed affect scale	3.1 (3)		
		Dementia mood assessment scale	2.0 (2)		
		Alzheimer's mood scale	2.0 (2)		
		UCLA loneliness scale	2.0 (2)		
		Subjective happiness scale	2.0 (2)		
Quality of life	Quality of life	*n=55*		*n=0*	
	Health related quality of life	Other	30.9 (17)		
	Life satisfaction	Short Form-12	14.5 (8)		
		EQ5D	14.5 (8)		
		Life satisfaction index	12.7 (7)		
		Dementia quality of life instrument	10.9 (6)		
		Short Form-36	9.1 (5)		
		WHO Quality of Life scale – short form	5.5 (3)		
		Short Form -8	3.6 (2)		
Sleep	Sleep quality	*n=28*		*n=0*	
	Nighttime Sleep time	Actigraphy or polysomnography	39.3 (11)		
	Daytime sleep time	Pittsburgh sleep quality index	28.6 (8)		

EQ5D= EuroQol 5-dimension quality of life scale; WHO=World Health Organization; n=number of times outcome was used

Table 5. (continued) Constructs and outcome measures used presented by the level of evaluation

		Level of outcome, measures used			
Domain	**Constructs measured**	**Person**	**n (%)**	**Facility**	**n (%)**
Responsive behaviours	Agitation	*n=37*		*n=0*	
	Verbal or physical aggression	Cohen-Mansfield agitation inventory	27.0 (10)		
		Neuropsychiatric inventory	18.9 (7)		
		Observation	13.5 (5)		
		Other	13.5 (5)		
		Not reported	10.8 (4)		
		Memory and behavioural checklist	5.4 (2)		
		Ease of care inventory	5.4 (2)		
		Minimum data set behaviour rating scale	5.4 (2)		
Discharge	Discharge destination	*n=19*		*n=4*	
	Length of stay	medical records or chart review	89.5 (17)	medical records or chart review	100 (4)
	Discharge rate	self-report	5.3 (1)		
	% discharged to community	goal attainment scaling	5.3 (1)		
	Successful/unsuccessful rehab				
	death/survival time from admission				
Feasibility	attendance	*n=30*		*n=0*	
	recruitment	therapist documentation	46.7 (14)		
	drop-out rate	research records	33.3 (10)		
	program adherence	Other	20.0 (6)		
	hostility to therapy				
	occurrence of adverse events				
	accuracy of intervention delivery				
	therapist's opinions and experiences				

n=number of times outcome was used

DISCUSSION

The current review demonstrates that the majority of PR interventions are delivered and evaluated at the resident-level with performance-based measures, ADLs, and mood being the most frequently reported outcomes. A key knowledge gap is research evaluating interventions and outcomes that reflect goals relevant to residents beyond mobility, falls, and independence, such as mood and quality of life. It is unclear whether the characteristics of the residents included are reflective of the medically complex residents who actually live in LTC. Therefore, length of stay of residents included in studies should be differentiated and both functional and palliative goals should be contemplated, such as relief from pain and living an active life until death. Intervention studies should explore realistic and sustainable delivery methods, evaluate PR at multiple levels (e.g., resident and facility) and tool development for determining service eligibility is imperative to ensure equality in access. Table 6 provides a summary of key take home points for clinicians and researchers in PR and LTC.

Table 6. Key points and take home messages

Key points	Evidence from scoping review
Researchers	
• Include residents who are reflective of those currently in long-term care (e.g., with cognitive impairment, medically complex)	• 23.4% of studies included only ambulatory residents, with very few specifically including non-ambulatory or bedridden, 16.3% included residents with evidence of dementia, 27.3% excluded medically acute
• Explore realistic and sustainable interventions (e.g., multidisciplinary integrated models of care)	• Frequently delivered by research staff, or physical therapist 3-5 days per week, 25-50 minutes, 10-18 weeks
• Examine short-stay	• Length of stay often not distinguished

models of care (e.g., convalescent care) • Explore and evaluate palliative models of care including rehabilitation (e.g., relief from pain and other symptoms, active life until death) • Analyze effects of rehabilitation interventions at facility- and system-levels (e.g., use quality indicators, healthcare transitions) • Develop tools for determining who could receive services	inclusion/exclusion criteria • 27.3% excluded medically acute, mood and quality of life less frequently used as outcome measures • Majority of outcomes reported at the resident-level • No validated tools for determining service eligibility were found
Clinicians • Top 5 papers to read for clinicians providing rehabilitation in long-term care:	1. Crocker T, Forster A, Young J, Brown L, Ozer S, Smith J, et al. Physical rehabilitation for older people in long-term care. Cochrane Database Syst Rev 2. 2013. 2. Valenzuela T. Efficacy of progressive resistance training interventions in older adults in nursing homes: a systematic review. J Am Med Dir Assoc. 2012;13(5):418-428. 3. de Souto Barreto P, Morley JE, Chodzko-Zajko W, H Pitkala K, Weening-Djiksterhuis E, Rodriguez-Manas L, et al. Recommendations on Physical Activity and Exercise for Older Adults Living in Long-Term Care Facilities: A Taskforce Report. J Am Med Dir Assoc 2016 May 1;17(5):381-392. 4. Guzman-Garcia A, Hughes JC, James IA, Rochester L. Dancing as a psychosocial intervention in care homes: a systematic review of the literature. Database of Abstracts of Reviews of Effects. 2013(3):914-924. 5. Silva RB, Eslick GD, Duque G. Exercise for falls and fracture prevention in long term care facilities: a systematic review and meta-analysis. J Am Med Dir Assoc. 2013;14(9):685-9.e2.
• 10 most frequently used outcome measures to evaluate physical rehabilitation in long-term care:	<u>Performance-based measures:</u> 1. Dynamometer 2. Timed Up and Go <u>Activities of daily living:</u> 3. Barthel Index 4. Functional Independence Measure <u>Mood:</u> 5. Geriatric Depression Scale 6. Philadelphia Geriatric Centre Morale Scale <u>Falls:</u>

7. Chart review/incident report
8. Falls Efficacy Scale

Quality of life:

9. Short-Form 12
10. Life Satisfaction Index

Evidence from the current review is in line with recently developed recommendations for physical activity in LTC.[40] However, the sustainability and applicability of the results to rehabilitation professionals such as physical therapists are questionable. First, research staff or physical therapists were most frequently reported to deliver resident-level PR interventions. Research staff delivering PR interventions precludes the ability for knowledge translation and integration of the PR intervention into practice. Significant gaps in facilitating knowledge into practice are evident in the LTC sector, with less than 5 percent of the knowledge translation literature focusing on LTC.[41,42] Second, the time and frequency for service delivery was on average approximately 45 minutes per session on 3 days per week and physical therapists were often reported as the professional delivering the intervention. In many jurisdictions, access to physical therapy is limited and requires a limited-time episode of care, whereby rehabilitation services are provided for short periods for residents to achieve specific, time-bound goals.[23] Therefore, the opportunity for ongoing physical therapy services delivered solely by a physical therapist is not realistic in the current health care climate. There is a need to explore the effectiveness of pragmatic, multidisciplinary PR interventions that will assist in moving research into practice in LTC.

Our review demonstrates that performance based measures or measures of ADLs, such as the Timed-Up and Go or the Barthel Index, are frequently used to evaluate the effect of PR in LTC. Clinicians can use these measures to evaluate their services within the context of the residents' functional goals. However, consideration should be given to a more comprehensive set of resident-centred goals. Though improving physical function has been identified as a priority for residents and health care providers and is often the target of PR,[43] independent ambulation may not be a realistic goal for all residents. Indeed, it has been suggested that rehabilitation requires a more extensive definition than merely achieving functional independence, in that consideration should be given to social, psychological and emotional health.[44,45] Therefore, clinicians should also consider measuring constructs aside from function such as mood and quality of life.

Based on the length of stay, cognitive and functional abilities of the residents included in the current literature regarding PR in LTC, the participants are not representative of the population of residents currently living in LTC homes. First, most articles included in the current review did not report the length of stay of residents. Though the majority of residents in Canada are long-stay,[15] there has been a recent increase in the number of short-stay, "convalescent" care beds in Ontario.[22] Internationally, there are other short-stay models, for example in the United States residents in skilled nursing facilities often return to the community, while in Europe there are specific wards dedicated to PR.[7,24,35] Only a small proportion of articles included in the current review explicitly described

a population of short-stay residents included in their study, suggesting there is room for future work to determine the most appropriate PR interventions for residents who may be admitted to LTC for short-term rehabilitation.

On the other hand, for the vast majority of residents who are indeed long-stay there is a need to include the expertise of PR into palliative care services. There is a global increase in the complexity and acuity of residents in LTC[31] and PR is relevant to several aspects of the principles of palliative care, as defined by the World Health Organization, including relief from pain and other symptoms and helping residents to live as actively as possible until death.[46] Alternatives to pharmaceutical management of pain and palliation have also been expressed as priority areas for research in LTC.[47] Additionally, while it is encouraging that a growing body of literature focuses on residents with dementia, only 16 percent of the literature about PR in LTC included residents with dementia. In contrast, more than 80 percent of the residents in LTC have some degree of dementia.[15] The discrepancy between the research and reality indicates that there may be selection bias within the current body of literature, where residents with dementia are excluded and the resulting population is not representative of the true LTC demographics.

The current review was unable to identify any validated tools or models for determining eligibility for PR services in LTC. Jurisdictional differences in rates of residents receiving rehabilitation services both nationally and internationally suggest that access to services does not match resident need.[6,8,34] Development of tools to ensure equality in access to services that match the

needs of residents is necessary so that services are received appropriately. Indeed, there may be subgroups of residents who require more intensive therapy while others may benefit from low volume maintenance programs, and residents admitted to LTC indefinitely may have different needs than those whose goals include returning to the community. Leadership and future tool development are needed to guide research and policy decisions around who should receive PR in LTC.

Study Limitations

An inherent limitation of a scoping review is that it provides breadth on a topic rather than depth.[25,26] The current review provides a broad view of PR interventions and how they have been evaluated in LTC, but is unable to describe the effectiveness of those PR interventions on specific outcomes. On the other hand, providing a breadth of knowledge may prove useful to several disciplines of knowledge users in LTC including service providers (e.g., rehabilitation professionals, nurses, kinesiologists), administration and policy-makers. The majority of the literature found in this review was from the United States, therefore conclusions around reported interventions and outcomes measured are likely more reflective of PR in the United States. Additionally, since articles reporting on the same study population were not grouped there may have been double counting of studies. However, all duplicate articles were removed so only articles with the same population but different outcomes were included. An additional limitation of the current study is that only studies and grey literature published in English were included, limiting the review to

articles published in English speaking countries or to those that have funds for translation services. Lastly, the scope of the current review is limited in providing recommendations for approaches to rehabilitation for all international groups as there may be additional literature not included in the search strategy. For example, “intermediate care” is used in the United Kingdom for rehabilitation in LTC homes and might not have been captured in our search.

CONCLUSION

The majority of PR interventions are delivered and evaluated at the resident-level and the most common outcomes reported are performance-based measures, ADLs, and mood. A key knowledge gap was the consideration of PR in relation to goals relevant to residents such as quality of life. The characteristics of the residents included in future studies should reflect the medically-complex residents who live in LTC and length of stay of residents included in studies should be differentiated. Intervention studies should also explore realistic and sustainable delivery methods, while tool development for determining service eligibility is necessary to ensure equality in rehabilitative care across the LTC sector.

CHAPTER 4 – STUDY 2

What do we know about physical rehabilitation and facility-level quality indicators in long term care? A scoping review and consensus process

INTRODUCTION

Quality indicators (QIs) are facility-level measures that are used internationally to capture the structure, process and outcomes within and between long-term care (LTC) homes. QIs can be publicly reported to encourage consumers to make informed decisions around the quality of service providers and to stimulate internal quality improvement strategies within LTC homes.[20] QIs can be used by frontline staff, policy-makers, and residents and their families to guide clinical decision making, evaluate and report treatment effectiveness, benchmark achievements, guide and evaluate quality improvement initiatives and strategic planning, implement guideline recommendations, inform policy, set national benchmarks and determine resource allocation.[33] In some countries, there is even a shift to base LTC payment on QI performance.[48]

There is an incentive to improve QI performance to receive additional, often scarce resources within the LTC sector. Furthermore, for those providing care, facility-level QI reporting can be a mode to advocate more effectively for additional resources. Physical rehabilitation (PR) is defined as active (e.g., exercise) and passive (e.g., therapeutic modalities) methods to maintain or improve mobility, physical activity, and overall health and wellness [5]. PR is an

element of interdisciplinary care in LTC that can influence QIs, particularly those related to physical function.[4] However, PR is provided to proportionally few residents internationally.[5-8] With scant resources, we need to understand how PR influences existing QIs to ensure quality PR is being provided and to advocate for increased funds to support rehabilitation initiatives. QIs provide a mechanism to evaluate effects of PR or quality improvement strategies at the facility-level. Indeed, several intervention trials in LTC have shown improvement in QIs.[49-51]

There had been a recent emphasis on the importance of using QIs to evaluate rehabilitative care,[33] but it is unclear which QIs should be used, particularly in LTC. First, evaluation of PR has occurred mostly at the resident-level with few studies reporting facility-level QIs.[17] Additionally, recent knowledge syntheses do not delineate which facility-level measures have been used.[17] To advance evaluation and practice, there is a need to determine which QIs could reflect quality rehabilitative care, and including specificity with respect to prevention of decline, maintenance or improvement in a QI. For example, LTC residents are susceptible to rapidly declining health. Therefore, does lack of improvement in physical functioning suggest poor quality rehabilitative care? Or is maintenance of physical functioning a more realistic goal for this population?[17] The purpose of the current study was to identify which facility-level QIs should be used to evaluate PR in LTC. We used a multi-method process to: 1) identify which QIs have been used to evaluate PR in LTC in the literature (addressed by

the scoping review); and 2) consult stakeholders to come to consensus on which QIs should be used (addressed by the consensus process).

METHODS - LITERATURE REVIEW

The protocol for the scoping review has been previously published.[36] A scoping review was conducted according to the framework proposed by Arksey and O'Malley[25] and the suggestions of Levac et al..[26] The research question for the scoping review was: which facility-level QIs have been used to evaluate the efficacy or effectiveness of PR in LTC?

Data sources

A comprehensive literature search was performed in August 2014, and was updated in May 2015 and December 2016. A liaison librarian performed the search in the following licensed databases: MEDLINE PubMed(1946-present), EMBASE Ovid(1974-present), CINAHL(1981-present), Cochrane Database of Systematic Reviews(1994-present), Physiotherapy Evidence Database, and Occupational Therapy Systematic Evaluation of Evidence database.[36] A structured grey literature search was run in December of 2014 and 2016 on the following websites as well as broad Google search: Canadian Institute for Health Information; Ministry of Health and LTC; National institute of Health, and the Government and Legislative Libraries Online Publications Portal; Canadian Physiotherapy Association; Ontario Long-term Care Association;

American Academy of Physical Medicine and Rehabilitation; and the University of Waterloo library catalogue (a full government depository library). The first 100 pages of Google Search were screened by two team members as per the same protocol employed for the literature review. The key concepts used in the searches were: PR, LTC, and evaluation including QIs.[36] The key concepts were combined using the Boolean Operator AND, and the search words within each concept were combined with OR (See Appendix 1). One final search was run in each database as the results for each research question may be applicable to the other research questions.[36]

Study selection

All abstracts were screened by two team members (CM and RP or JCG). A third party arbitrated in instances of disagreement. Articles were included based on the following criteria: 1) participants must reside in a LTC home defined as a home for residents who are unable to live independently, requiring access to nursing, personal care, support and/or supervision;[37] 2) more than half of the participants must have a mean or median age of 65 or older; 3) focus of the article is PR as defined by the Canadian Physiotherapy Association:

"*Promoting optimal mobility, physical activity and overall health and wellness; Preventing disease, injury, and disability; Managing acute and chronic conditions, activity limitations, and participation restrictions; Improving and maintaining optimal functional independence and physical performance; Rehabilitating injury and the effects of disease or disability with therapeutic exercise programs and other interventions; and Educating and*

planning maintenance and support programs to prevent re-occurrence, re-injury or functional decline."

(http://www.physiotherapy.ca/getmedia/e3f53048-d8e0-416b-9c9d-38277c0e6643/DoPEN(final).pdf.aspx)[4] where PR is provided via physical therapy, occupational therapy, nursing, recreation therapy, or restorative care; 4) presents a facility-level QI used to evaluate PR. Case studies, mixed methods, prospective, longitudinal, retrospective case-control, randomized controlled trials, quasi-randomized clinical trials or controlled trials, clinical practice guidelines, systematic reviews, and relevant reports generated by policy makers were included. Articles were excluded if they were non-English full texts, clinical commentaries, editorials, interviews, legal cases, letters, newspaper articles, patient education handout, abstract or unpublished literature.

Data extraction

Data was extracted in duplicate by two team members (CM and RP or JCG) using a pilot-tested data abstraction form. If disagreement occurred, a third party arbitrated. Data extracted from the articles included: title, authors, location (country), type of literature (e.g., peer-reviewed paper, policy report), study design (e.g., randomized controlled trial, cohort study), purpose of the study or report, number of facilities included, measure of rehabilitation provided, and a summary of the main findings. The information extracted regarding the QI included: name, description of calculation (numerator, denominator, risk adjustment, inclusion/exclusion criteria), description of data source for derivation of QI, stakeholder engagement process (yes/no, description of

process), average prevalence/incidence, variance, sensitivity for change, and timeframe for improvement.[36] Though studies were not formally assessed for quality (e.g., blinding of assessors, randomization), the study design was extracted and reported as a proxy measure of quality.

METHODS - CONSENSUS PROCESS

Nominal group technique (NGT) is an exploratory, mixed-method consensus method that brings experts together to explore solutions for situations requiring complex problem solving, priority setting or decision making.[29] NGT involves a question posed to the group by a facilitator, the participants individually responding to the question, followed by small face-to-face group discussion to prioritise the ideas.[29]

The group of participants in a NGT consensus process must have expertise relevant to the question being asked.[29] Therefore, experts in PR and LTC were identified by the study team through key informants, contacted by the first author, and were invited to participate in an in-person consensus meeting. Participants were chosen based on their expertise in PR and LTC, and a representative from each of the following groups was invited: LTC service providers and clinicians (e.g., physical therapists, nurses, physicians), QI developers and users, policy-makers, and academics.

Prior to the in-person consensus meeting, participants were provided with the definition of a QI as follows: "aggregated resident-level data expressed as a fraction where the numerator is the number of residents with a particular outcome, and the denominator is the number of residents at risk for developing that outcome who are not otherwise excluded",[18] and a list of example QIs currently being used in the LTC context in Ontario (Table 7).

Table 7. Quality indicators presented to stakeholders prior to in-person consensus meeting

Domain of quality indicator	Quality indicator description
Wait times	Median number of days to LTC home placement
Incontinence	Percentage of residents with worsening bladder control
Activities of daily living	Percentage of residents with increasing difficulty carrying out normal everyday tasks
Cognitive function	Percentage of residents whose language, memory and thinking abilities have recently decreased
Pain	Percentage of residents with pain that got worse recently
Falls	Percentage of residents who had a recent fall
Pressure ulcers	Percentage of residents who had a pressure ulcer that recently worsened
Restraints	Percentage of residents who are physically restrained
Medication safety	Percentage of residents prescribed a drug that should never be used among the elderly per 100, 000 residents aged 65 and up
Human health resources	Number of injuries per 100 long-term care workers per year
Infections	Percentage of resident with one or more infections (urinary tract infection, pneumonia, respiratory infection, septicimia, viral hepatitis, wound infection, fever and recurrent lung aspiration)
Other	Please describe

LTC=long-term care

The presented QIs are not specific to rehabilitation and were chosen as they are the QIs currently publicly reported in Canada. Though some of the QIs had little direct relevance to PR (e.g., wait times), the entire list was provided to the group of stakeholders so as not to bias their decision around which ones could be used to evaluate PR. These QIs are calculated using the Resident Assessment Instrument Minimum Data Set (RAI 2.0), are a valid reflection of quality of care activities within the home, and have adequate to good reliability.[52,53] After reviewing the definition of a QI and the list of currently reported QIs, participants were asked to complete an online survey where they were asked: "What do you think should be the QIs used to evaluate PR in LTC?" They were asked to pick their top three choices from the provided list or to choose "other" and provide a description.

At the in-person consensus meeting, the first author presented the results of the scoping review and the results of the pre-meeting online survey (presented as the frequency of votes for each QI). Participants were assembled in groups of five to six people, so that each group contained a diverse set of stakeholders (e.g., a clinician, policy-maker, and QI developer). Group discussions were led by a facilitator from the study team, and each facilitator followed the same semi-structured focus group guide. Participants were asked to discuss whether they agreed with the rankings, if they were surprised by any omissions, and if there were any other QIs that should be considered. Participants were then asked to independently rank the QIs from 1 to 3, with 1 being "most important". The

weighted ranking was calculated by assigning each QI labelled as "1" a value of 3, 2 to those labelled as "2" and 1 to those labelled as "3", and summing all the rankings for each QI. The results of the weighted rankings were presented back to the large group and they were asked to discuss the same questions in a large focus group. All focus groups were audio-recorded and transcribed verbatim. Descriptive content analysis[54,55] was used to analyze the qualitative data obtained from the focus groups. The results of the descriptive content analysis were used to support reasoning and decision-making behind the rankings of the QIs. All data were analyzed by two members of the study team, with third party arbitration if disagreement occurred. First, data were coded for general themes of information, then reassembled and grouped into more specific themes and subthemes based on patterns and relationships in the data.[55] Trustworthiness of the data were achieved through member checking.[56] A summary of the results of the discussions were sent to each participant and they were asked to state whether or not they agreed that the summary accurately reflected the discussions, and whether they had any additional comments. Participants identified the summary was accurate and no changes were made. Ethics approval was obtained from the research ethics board at the University of Waterloo and participants provided informed consent.

RESULTS OF DATA SYNTHESIS

Of the 881 full-text articles screened for inclusion, three peer-reviewed articles (one retrospective correlational study,[57] one cross-sectional correlational study,[58] and one randomized controlled trial[59]) and two grey literature reports[32,60] described QIs used to evaluate PR in LTC (Figure 4, Table 8). Two were from the United States[57,60] while the remainder were from Finland,[58] Taiwan,[59] and Canada.[32] The number of facilities included in the articles and reports ranged from seven[59] to 966.[32]

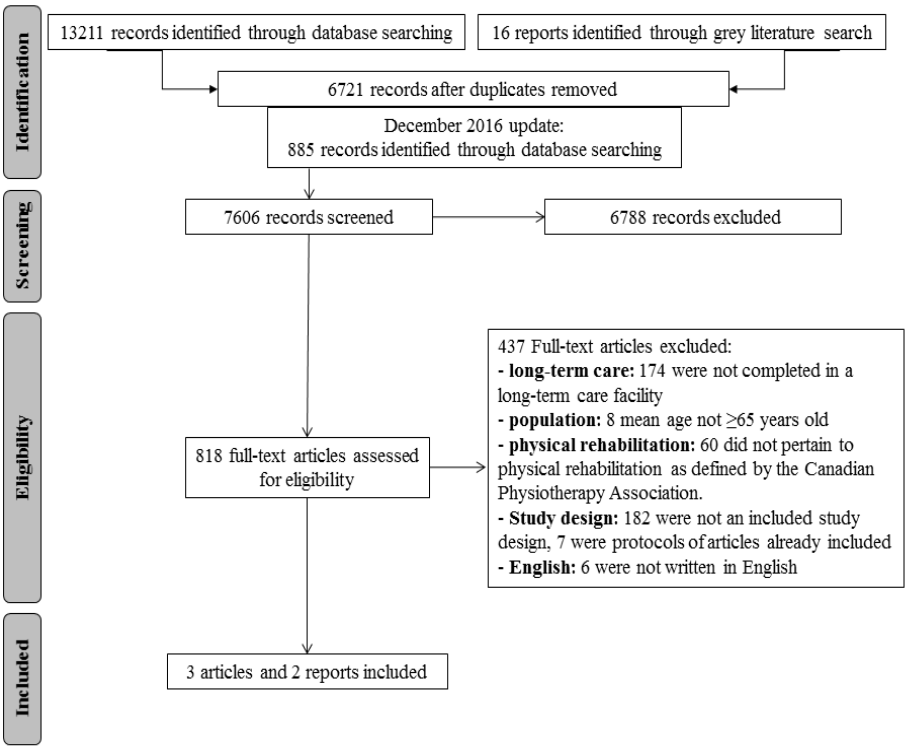

Figure 4. Flow of studies through the scoping review

Table 8. Description of articles using quality indicators to evaluate physical rehabilitation in long-term care

Author, year	Country	Type of publication	Study design	Sample size	Purpose of study/report
Silverstein, 2006[57]	United States	Peer reviewed article	retrospective correlational study	211 special nursing facilities	To examine the usefulness of the nursing home QIs for differentiating among providers for rehab purposes
Vahakangas, 2008[58]	Finland	Peer reviewed article	cross-sectional correlational study	256 care units	To examine the association between rehabilitation care practices and quality outcomes
Wu, 2010[59]	Taiwan	Peer reviewed article	randomized controlled trial	7 LTC facilities	To evaluate the clinical effectiveness of an integrated care model
Canadian Institute for Health Information, Canada, 2013[32]	Canada	Grey literature	Report, expert opinion	966 nursing homes	To provide a baseline for tracking the quality of care in Canadian LTC homes
Centre for Medicare & Medicaid Services, USA, 2014[60]	United States	Grey literature	Report, expert opinion	Not applicable	Describe a specifications of a new quality measure for functional status

LTC=long-term care

Table 8. (continued) Description of articles using quality indicators to evaluate physical rehabilitation in long-term care

Author, year	Measure of rehabilitation	Main findings
Silverstein, 2006[57]	FIM, percentage of residents discharged to the community, "prepared to manage"	- No quality measures correlated with any rehab outcomes - Residualized FIM motor gain did not correlate with any QI or quality measure -Prevalence of restraints correlated with community discharge percentage - Incidence of decrease in range of motion negatively correlated with "prepared to manage care at discharge"
Vahakangas, 2008[61]	Amount of rehabilitation nursing provided	- High rates of rehab were associated with lower prevalence of bedridden residents and lower rates of residents with little or no activity - No statistical significance with the other QIs
Wu, 2010[59]	Interdisciplinary care team including geriatrician, nurses, physical therapists, dietitians, and social workers, actively participated in daily care with onsite staff	- unplanned feed tube replacement was significantly reduced in integrated care model - all other QIs were not significantly different
Canadian Institute for Health Information, Canada, 2013[32]	n/a	"…variation in performance suggests differences across facilities in their approach to restorative care."
Centre for Medicare & Medicaid Services, USA, 2014[60]	n/a	"This quality measure addressed the importance of 1) conducting a comprehensive functional assessment at the time of admission…."

FIM=functional independence measure; QI=quality indicator

An activities of daily living QI was reported in two of the peer-reviewed articles[57,58] with both using a decline in late-loss activities of daily living (bed mobility and eating), while one grey literature report[32] discussed residents who improved their ability to transfer and walk or wheel. Two of the peer-reviewed papers reported a physical activity QI (little or no activity), the prevalence of bedridden residents, and of bowel and bladder incontinence.[57,58] One QI reflecting whether a functional assessment was completed was used in the other grey literature report.[60] Other QIs examined are found in Table 9. Only the grey literature reports[32,60] described some, but not all elements of the calculation (i.e., numerator, denominator) of the QIs reported. The QIs that appeared to be related to rehabilitation delivery or outcomes were decreased range of motion,[57] lower prevalence of bedridden residents and residents with little or no activity,[58] and unplanned feed tube placement.[59] Limited evidence to support the use of a specific QI to evaluate PR was available in the included articles. Only two peer-reviewed and one grey literature report identified the source of data derivation;[32,57,58] one reported the involvement of a consensus process;[60] one reported the prevalence and variance,[32] and none reported the sensitivity or timeframe for change (Table 9).

Table 9. Evidence for use of quality indicators to evaluate physical rehabilitation in long-term care

Author, year of publication	Silverstein, 2006[60]	Vahakangas, 2008[61]
Quality indicator(s) examined	All nursing home quality indicators: - incidence of new fracture, prevalence of falls, prevalence of behaviour symptoms affecting others, prevalence of symptoms of depression, prevalence of symptoms of depression without antidepressant therapy, use of 9 or more different medications, incidence of cognitive impairment, prevalence of bladder or bowel incontinence, prevalence of occasional or frequent bowel or bladder incontinence without a toileting plan, prevalence of indwelling catheter, prevalence of fecal impaction, prevalence of urinary tract infections, prevalence of weight loss, prevalence of tube feeding, prevalence of dehydration, prevalence of bedfast residents, incidence of decline in late loss activities of daily living, incidence of decline in range of motion, prevalence of antipsychotic use in absence of psychosis, prevalence of anti-anxiety/hypnotic use, prevalence of hypnotic use >2 days per week, prevalence of daily physical restraints, prevalence of little or no activity, prevalence of stage 1-4 pressure ulcers	- prevalence of bowel and bladder incontinence - prevalence of bedridden residents - incidence of decline in late-loss activities of daily living - prevalence of little or no activity - prevalence of stage 1-4 pressure ulcers
Data source derivation	RAI-MDS	RAI-MDS
Numerator	Not reported	Not reported
Denominator	Not reported	Not reported
Inclusion/ Exclusion	Not reported	Not reported
Consensus process	Not reported	Yes – reviewed by several national clinical panels including all disciplines involved in delivering care
Prevalence	Not reported	Not reported
Variance	Not reported	Not reported
Sensitivity	Not reported	Not reported
Timeframe for change	Not reported	Not reported

RAI-MDS=resident assessment instrument – minimum data set

Table 9. (continued) Evidence for use of quality indicators to evaluate physical rehabilitation in long-term care

Author, year of publication	Wu, 2010[62]	Canadian Institute for Health Information, Canada, 2013[33]	Centre for Medicare & Medicaid Services, USA, 2014[63]
Quality indicator(s) examined	- unplanned feed tube replacement - unplanned urinary catheter replacement - emergency department visit - hospitalization - incidence of urinary tract infections, pneumonia, pressure sores	- percentage of residents who maintained independence or improved their ability to walk or wheel around the nursing home in the 90 days prior to assessment	- percentage of LTC hospital patients with an admission and discharge functional assessment and a care plan that addresses function
Data source derivation	Not reported	RAI-MDS	Structured functional status checklist
Numerator	Not reported	Residents with better activities of daily living self-performance (increased activities of daily living Long Form score) on their target assessment compared with prior assessment	number of LTC patients with at least one functional goal on admission assessment
Denominator	Not reported	Residents with valid assessments, excluding comatose and end-of-life residents	number of LTC patients, of all ages, excluding those with incomplete stays because of medical emergency, those who leave against medical advice, or patient dies while in LTC
Inclusion/ Exclusion	Not reported	Not totally dependent in transferring; Locomotion problem; Age younger than 65	Not reported
Consensus process	Not reported	Not reported	Not reported
Prevalence	Not reported	30%	Not reported
Variance	Not reported	18-41%	Not reported
Sensitivity	Not reported	not reported	Not reported
Timeframe for change	Not reported	over past 90 days	Not reported

LTC=long-term care; RAI-MDS=resident assessment instrument - minimum data set

RESULTS OF CONSENSUS PROCESS

Fourteen stakeholders from PR and LTC participated in the consensus process (Table 10). Falls and activities of daily living received both the highest number of votes for the pre-meeting online vote (Figure 5a), and the highest weighted ranking (Figure 5b).

Table 10. Demographics of participants in consensus process (N=14)

Age, mean (SD)	48.2 (9.1)
Sex, % female (n)	57.1 (8)
Professions	Physician, medical director of LTC home, vice president LTC physicians' association
	Physiotherapist, regional rehab lead, executive member physiotherapy association
	Registered nurse, regional manager of clinical services for LTC homes
	Kinesiologist, program coordinator of active living program in 15 LTC homes
	Director of research, 15 LTC homes and Institute for Aging
	Occupational therapist, associate professor
	Family physician with specialization in mobility and aging
	Occupational therapist, national director of rehab and recreation for LTC homes
	Physiotherapist, project manager for rehab working group
	Director of operations, physiotherapy service provider
	Manager, provincial health quality improvement organization
	Project lead, provincial osteoporosis strategy
	Physiotherapist
	Professor of physical therapy, expert in geriatrics

SD=standard deviation; LTC=long-term care

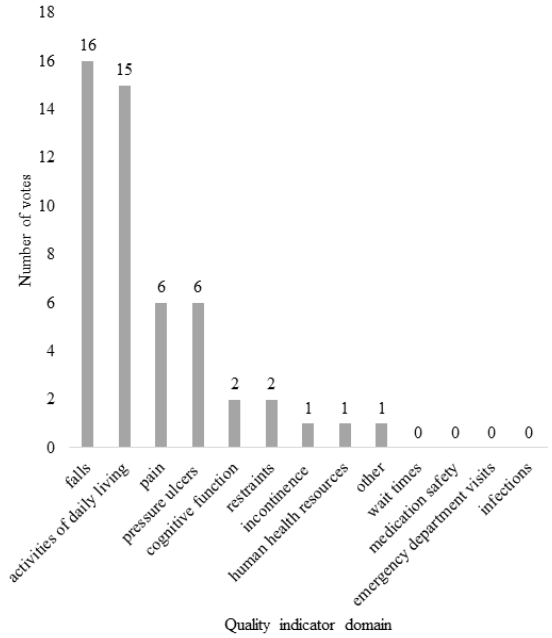

Figure 5a. Results of online pre-meeting vote

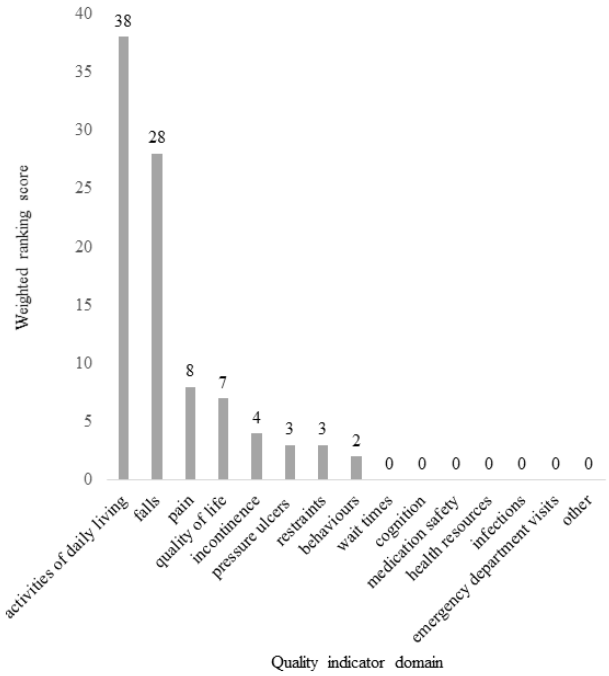

Figure 5b. In-person consensus meeting weighted ranking results

Theme 1. Consider a variety of QIs in relation to each other and across settings

Participants agreed that activities of daily living and falls were the most obvious QIs to be directly affected by PR, suggesting that the other QIs (e.g., incontinence and pressure ulcers) would be indirectly affected by PR, therefore not as applicable. However, participants wanted to ensure that QIs such as pain and quality of life not be disregarded, and reported uneasiness limiting the ranking to the top three most important: *"Well I would hate to see quality of life, incontinence and pressure ulcers and restraints to sort of fall off there."* Participants voiced the need to consider the importance of all QIs in relation to each other e.g., a positive change in one QI may create a negative change in the other. For example, keeping residents less mobile to prevent falls could impair activities of daily living, therefore performance on a falls QI would improve but activities of daily living may be worse. One participant stated: *"…as we provide PT (physical therapy) and get people mobile they may fall more – so there's a risk in keeping some of these, with more intensive rehab some of these indicators may actually go up."* Lastly, the importance of choosing a set of QIs that could be used across the continuum of care in settings where frail, older adults reside (LTC, post-acute care, convalescent care and complex continuing care) was raised, allowing for comparisons across these settings.

Theme 2. Risk-adjustment and confounders

Participants discussed the role of risk-adjustment and confounders when exploring the relationship between PR and facility-level QIs. First, the importance of risk adjustment was emphasized, especially when comparing between homes that have different populations (e.g., homes with a greater number of residents with dementia) or across different settings (e.g., LTC versus complex continuing care) as the size of the effect of PR might differ depending on the population. A participant described: *"I think you've brought up something really important there, because we have to fund four city homes that are really high functioning, younger population and then we have rural homes that are heavy, end-stage care, and then you may have your higher functioning dementia care units that they are there for safety as opposed to physical care."* Second, confounding variables may affect the QI aside from PR. For example, if few residents are receiving PR in a LTC home, it is unlikely that PR will influence QIs at the facility level. Another example is that pain medications may confound a pain QI. For example, a participant suggested, *"Well one of the challenges is that all of these indicators had multiple dimensional causes and it's not only a physio or an OT (occupational therapist) who is going to save the day or not save the day, it's part of an organizational responsibility. I think there are rehab interventions that can affect pain, just like there are medication regimens that can affect it."*

Theme 3. QI specifications

Participants felt comfortable voting for the domain of the QI (e.g., activities of daily living), but less comfortable voting for what the QI should specifically measure (e.g., improvement versus maintenance of function; early-, mid-, or late-loss activities of daily living). For example, one participant explained, *"The issue of activities of daily living measurement - I think that there is an important discussion to be had, in terms of measuring prevention of decline versus improvement versus maintenance."* Participants discussed that for some residents, maintenance of activities of daily living is appropriate while for others a lack of improvement could indicate poor quality care: *"It also, maintenance could also be failure if the person could actually improve."* Consensus could not be reached on which specific QI would be best to explore in relation to PR, and it was decided that both improvement in and maintenance of activities of daily living should be examined.

Key points arising from the scoping review and the consensus process are highlighted in Figure 6.

- Activities of daily living and falls quality indicators should be used to evaluate the relationship between physical rehabilitation and facility-level quality indicators
- Other quality indicators that should be explored in relation to rehabilitation include: pain, quality of life, mood, restraints, incontinence, pressure ulcers
- Quality indicators should be examined in relation to each other (e.g., does an improvement in one result in a decrease in another)
- A set of quality indicators that can be used across settings for frail, older adults (e.g., long-term care, post-acute care, complex continuing care) should be developed
- Risk adjustment and confounders must be explored
    - Risk adjustment: account for different populations in long-term care (e.g., rates of dementia, Parkinson's disease)
    - Confounders identified: amount of rehabilitation provided within the home, other rehabilitation programs occurring within the home (e.g., occupational therapy, recreation therapy, restorative care), and pain medication
- Both an improvement in and maintenance of activities of daily living should be examined

Figure 6. Key points from the scoping review and consensus process

DISCUSSION

The scoping review and consensus process identified that facility-level QIs measuring activities of daily living and falls should be used to evaluate PR in LTC. However, whether we should use maintenance or improvement, or the

early-, mid- or late- activities of daily living QI could not be determined because of limited evidence to support one or the other. Additional QIs that should be considered when evaluating PR are resident-centred QIs such as mood, quality of life, and pain. Facility-level factors (e.g., the proportion of residents with dementia, the proportion of residents receiving PR) must be taken into consideration for risk-adjustment and confounding.

When using QIs to evaluate PR in LTC, it is prudent to consider which specific activities of daily living may be affected by PR. Three areas of activities of daily living performance have been identified: early-loss (personal hygiene and dressing), mid-loss (transferring, walking, and toileting) and late-loss (feeding and bed mobility).[61] A systematic review and meta-analysis revealed that PR improved activities of daily living performance by 1.3 points on the Barthel Index.[12] The Barthel Index covers all areas of activities of daily living performance including feeding, bathing, grooming, dressing, bowel and bladder, toilet-use, transfers, mobility and stairs.[62] However, it remains unclear if PR has a greater effect on any one of these performance areas. The effect on each performance area may vary depending on the goal of PR. Nonetheless, given the target of PR is often to improve transfers and mobility,[17] mid- and late-loss activities of daily living may be a starting point to investigate the effect of PR. Future work is required to test this hypothesis and to determine if PR influences mid-loss activities of daily living QIs.

Second, when reporting and interpreting QI scores for activities of daily living, it is critical to determine whether it is improvement in activities of daily living

performance or prevention of decline that is most relevant. Improvements in activities of daily living performance due to PR intervention have been shown to be relatively small.[12] Previous authors have suggested that a small improvement is reflective of a maintenance of function, which is extremely important for a population of frail, dependent residents.[12] Further, maintenance of independence may be a more appropriate measure of the effect of PR interventions in LTC.[12] When examining the effect of PR on QIs it is imperative to consider whether increasing the proportion of residents who improve their activities of daily living or the proportion of residents who fail to decline in their activities of daily living is more reflective of quality care.

Additional facility-level QIs that were identified to evaluate PR in LTC were mood, quality of life, and pain. Indeed, there has been a recent shift to view the goals and outcomes of PR care in LTC through a more resident-centred, comprehensive view. Activities of daily living and falls are the most obvious outcomes to evaluate PR, as they are often the reported goals of care.[17] However, for the medically complex, often end-of-life long-stay residents in LTC, mood and quality of life may in fact be more important than achieving functional independence.[44,45] There are QIs in the RAI-MDS measuring the proportion of residents with improvement or decline in depression, anxiety, and pain symptoms that can be used in LTC.[19] Additionally, there is an interRAI quality of life survey instrument measuring 10 domains of quality of life.[63] Rehabilitation could certainly play a role in improving health-related quality of life. Therefore, future studies examining the facility-level effect of PR should

also examine QIs representing mood, quality of life, and pain in additional to those measuring functional ability.

Facility-level factors, such as the proportion of residents with dementia or other conditions, may modify or confound the effect of PR on QIs. For example, homes that have units dedicated for residents with significant cognitive impairment may have higher levels of functional decline,[64] and a higher rate of functional decline or lack of improvement may be related to the higher proportion of residents with dementia rather than poor quality PR services. On the other hand, having a higher proportion of residents admitted from acute care to the LTC home may reflect a higher rehabilitation potential rather than high quality PR services. Though QIs are often risk-adjusted for potential confounders, not all possible confounders are included in the QI calculation and risk-adjustment cannot entirely remedy the effect of all confounders.[65] Therefore, a carefully constructed list of possible confounders should be established for examination in addition to the relationship between PR and facility-level QIs. Confounders identified in the current study were proportion of residents receiving rehabilitation, other rehabilitation programs occurring within the home (e.g., occupational therapy), and pain medications.

A strength of the current study is that it is the first article to provide suggestions for which QIs should be used to evaluate PR in LTC through a combination of scoping review and nominal group technique methodology. Nominal group technique can be limiting as only one question can be discussed at a time. In the current study, it was only possible to identify the domain for the QIs that should

be used without being able to fully explore the specifications of the QIs. Additionally, only studies and grey literature published in English were included, limiting the review to articles published in English speaking countries or to those that have funds for translation services. However, we now have an idea of which QIs to explore in relation to PR, including ones that have not been used in the past (e.g., mood, quality of life). Our next steps are to evaluate the relationship between PR and several activities of daily living and falls QIs, including both an improvement in and prevention of decline in activities of daily living.

CONCLUSION

Activities of daily living and falls QIs should be used to evaluate PR in LTC. However, the most appropriate specifications of activities of daily living QIs to evaluate PR remains unclear. Additional QIs that should be used include resident-centred QIs such as pain, quality of life, and mood. Risk adjustment and confounders must be considered including facility-level factors that may influence the QI such as the proportion of residents with dementia, and the proportion of residents receiving PR.

CHAPTER 5 – STUDY 3

What is the relationship between facility-level activities of daily living and falls quality indicators and rehabilitation in Canadian long-term care homes?

INTRODUCTION

The quality of care delivered in long-term care (LTC) homes has been a matter of interest for several decades in Canada and internationally. Concerns about quality care provision is a research priority in the LTC sector.[32,47,66] Quality indicators (QIs) are tools used to indicate the quality of performance of LTC homes, and to compare and contrast quality within and between homes.

QIs are objective measures of processes, structures and outcomes.[33] For the purpose of this study, a QI will be defined as aggregated resident-level data expressed as a fraction where the numerator is the number of residents with a particular outcome, and the denominator is the number of residents at risk for developing that outcome who are not otherwise excluded.[18] QIs can reflect either the prevalence or incidence of a particular outcome at a specific time.[65] For example, a prevalence QI would be the number of residents in a home that have a decubitus ulcer, while an incidence QI would be the number of residents who have worsening decubitus ulcers as compared to their previous assessment. QIs are also often risk adjusted to allow for equitable comparison across residents and facilities.[67] At the resident-level QIs are risk-adjusted for characteristics of the resident that increases their risk of developing a condition,

but that the facility has little to no control over and therefore are not reflective of quality care.[67] Facility-level risk adjustment accounts for the fact that homes may have differences in the outcome of interest at baseline and therefore might have a differing proportion of residents who improve or decline based on chance and independent of the facility's quality of care.[65,67] QIs have been shown to be a valid reflection of quality of care activities and preventative and responsive strategies within the home, and to have adequate to good reliability.[52,53]

In Ontario, QIs are publicly reported to allow residents and their families to make informed decisions about the care they are receiving or to aid them in deciding which LTC home to choose.[20] QIs are also often used by policy-makers to assist in decision-making about resource allocation and policy. Recently, QIs have been identified as important for rehabilitation professionals to help guide clinical decision making, evaluate and report treatment effectiveness, benchmark achievements, guide and evaluate quality improvement initiatives and strategic planning, implement guideline recommendations, inform policy, set national benchmarks and determine resource allocation.[33] Though the interest in and utility of using QIs is evident, there is a need to identify which QIs would be most appropriate for evaluating rehabilitative care in LTC.

Physical rehabilitation (PR) is one of several interdisciplinary services provided within LTC homes in Canada. PR focuses on improving or maintaining physical function in the context of chronic illness or injury.[4] Changes in activities of

daily living (ADLs – dressing, personal hygiene, walking and locomotion, transferring, eating, toileting, and bed mobility) and falls have been identified as the most relevant domains that could reflect quality PR within the LTC context (see Study 2 results). Further, ADLs and falls are often used as outcomes when evaluating resident-level changes in response to PR interventions.[17] Indeed, even a small improvement in ADLs could reflect quality rehabilitative care for a population vulnerable to rapidly declining health.[17] On the other hand, a lack of improvement among residents who have the potential to improve could reflect poor quality care.[17] Though ADLs in general have been identified as an appropriate domain to evaluate PR in LTC, it is unknown which specific ADLs (i.e., early-loss: dressing, personal hygiene; mid-loss: toilet use, transferring, locomotion; or late-loss: bed mobility, eating) would best reflect the effects of PR. For example, would an improvement in mid-loss ADLs be more reflective of receiving quality PR care than a prevention of declining early-loss ADLs? Late-loss ADLs and falls were identified as the most practice sensitive QIs for nurses, however allied health professionals such as physical therapists were not included in this study.[68] An examination of the relationship between ADL and falls QIs and PR provision within LTC homes will provide an idea of which QIs would be most responsive to PR.

Therefore, the primary research question of the current study is: what is the relationship between PR and facility-level ADLs (early-, mid- and late-loss) and falls QIs within LTC homes across four Canadian provinces? The secondary questions are: 1) What is the distribution of ADL and falls QIs across LTC

homes in Canada? 2) What other facility level factors (e.g., proportion of residents with a diagnosis of stroke or Parkinson's disease, or who have received antipsychotics in the last week) are related to QI performance? Our primary hypothesis is that excellent performance on mid-loss ADLs (i.e., fewer residents declining and more residents improving in mid-loss ADLs) will be positively associated with the proportion of residents receiving rehabilitation in the home.

METHODS

The study was a retrospective, secondary data analysis. Data was obtained from the LTC Facility Resident Assessment Instrument (RAI) 2.0 (Centers for Medicare & Medicaid Services, Baltimore, MD) for all LTC homes in Ontario, Manitoba, British Columbia, and Alberta. Nova Scotia, Newfoundland, Saskatchewan and the Yukon had too few homes to include in analyses, and the other provinces and territories in Canada do not use the RAI 2.0, therefore data were not available. The analysis was restricted to facilities classified as 24-hour nursing care. Complex continuing care facilities were excluded from Ontario's data, as their levels of service provision are different from those of LTC homes. The RAI 2.0 is a valid and reliable standardized assessment tool administered by trained assessors within LTC homes, which combines chart review with interaction with residents, their families and the clinicians who work with them.[69-71] The RAI 2.0 is administered in Canadian LTC homes within 14 days

of admission, on a quarterly basis thereafter, or if there is a significant change in status.

The eight QIs listed in Table 11 were calculated for each facility in each of the included provinces and territory for the period of January 1st to March 31st of 2015. Though several methods of risk-adjustment exist, the current study used that of the third-generation RAI QIs: restriction, indirect standardization, and stratification with direct standardization.[72] Restriction involves excluding residents that do not reflect the quality of care within a home (e.g., new admissions). Next, residents were sorted into strata based on their risk level (i.e., low, medium, and high) relative to a cross-national standardization sample. Within the strata, indirect standardization was performed which involves multivariable adjustment for individual resident level characteristics (e.g., cognition). Table 11 provides a complete description of covariates used for adjustment of each QI. For each stratum, regression coefficients were used to determine the expected number of residents triggering the QI in a given facility, and strata-specific scores were combined using weights from the standard population.[72] Homes with QI denominators with a value less than 30 were excluded, as the estimate becomes unstable at this point. One final continuous, absolute value was output for each facility from the calculation. However, interpretation of care quality should not placed on the absolute value of the QI but on the QI relative to overall sample mean used in the standardization procedure.[72] Therefore, facilities were classified based on their percentile ranking which reflects the quality of their performance relative to other LTC

homes in Canada: below the 20th percentile (reflecting excellent quality for QIs where a lower score indicates better performance, and poor quality for QIs were a higher score indicates better performance), above the 80th percentile (reflecting poor quality for QIs where a lower score indicates better performance, and excellent quality for QIs where a higher score indicates better performance), or between the two (reflecting average quality).

To describe the distribution of ADL and falls QIs by province, a box plot for each QI across the four provinces was created. Since the 20th and 80th percentile and median are clinically meaningful (as described above), the box plot was created such that the bottom on the box represented the 20th percentile, the top represented the 80th, and the line inside the box indicated the median. A cumulative proportional odds model using a generalized estimating equation stratified by province was used to determine the relationship between rehabilitation and other facility-level characteristics, and each of the ADL and falls QIs. Each facility-level explanatory variable hypothesized to have a relationship with the QI was first tested in a bivariate regression adjusted for the control variables (see Table 12 for a description of each variable). The model for Manitoba was only controlled for income quintile as every LTC home in Manitoba is in the same health region, in an urban centre, and most are large homes. Explanatory variables significant at $p < 0.2$ were added to the multivariable regression models. An alpha of $p < 0.2$ was used as a conservative estimate of variables that could be potentially significant in the final model. Variables were entered in a backward stepwise multivariable regression and

were retained within the multivariable model at an alpha level of $p < 0.01$. It was hypothesized that the facility-level characteristics from the quarter prior to the QI calculation would have the greatest affect on the QI; therefore, all control and explanatory variables were calculated for October 1st to December 31st, 2014. Since QIs are already risk adjusted based on resident-level characteristics, resident level attributes were not included in modelling. All statistical analyses were completed in SAS version 9.4 (SAS Institute Inc., Cary, NC).

Table 11. Description of quality indicators used as response variables

Description of quality Indicator	Numerator	Denominator	Exclusions	Risk Adjustment	
				Individual-level covariates	Facility-level stratification
Proportion of residents with worse late loss ADLs	Residents with worse late-loss ADL-self performance compared to last assessment	Residents whose late-loss scores could decline (i.e., did not have maximum score on last assessment)	Comatose, end of life	Age < 65	ADL long form*
Proportion of residents with improved or remained independent in mid loss (transfer and locomotion) ADLs	Residents with improved mid-loss ADL self-performance compared to prior assessment, or a score of 0 on both prior and current assessment	Resident with valid assessments	Comatose, end of life	Age < 65, CPS	ADL long form*
Proportion of residents with improved or remained independent in early loss (dressing and personal hygiene) ADLs	Residents with improved early-loss ADL self-performance compared to prior assessment, or a score of 0 on both prior and current assessment	Resident with valid assessments	Comatose, end of life	Age < 65, RUG late-loss ADL scale	CPS
Proportion of residents with improved late loss ADLs	Residents with improved late-loss ADL self-performance compared to prior assessment	Residents whose late-loss ADL score could improve (i.e., did not have maximum score on last assessment)	Comatose, end of life	PSI – Subset 1 – diagnoses CPS RUG behaviour RUG cognitive impairment Age < 65	CMI

ADL=activities of daily living; CPS=cognitive performance scale, RUG=resource utilization group, CMI=case mix index, PSI=patient safety indicator
**Note: ADL long form is measure of overall ADL performance*

Table 11. (continued) Description of quality indicators used as response variables

Description of quality Indicator	Numerator	Denominator	Exclusions	Risk Adjustment	
				Individual-level covariates	Facility-level stratification
Proportion of residents with worse or remained completely dependent in mid loss (transfer and locomotion) ADLs	Residents with worse mid-loss ADL[1] self-performance as compared to prior assessment or a score of 0 on both prior and current assessment	Residents with valid assessments	Comatose, end of life	Not totally dependent in transferring, locomotion problem, PSI-subset 2-non-diagnoses, age <65	CMI
Proportion of residents with worse or remained completely dependent in early loss (dressing and personal hygiene) ADLs	Resident with worse early-loss ADL[1] self-performance as compared to prior assessment, or a score of 0 on both prior and current assessment	Resident with valid assessments	Comatose, end of life	Not totally dependent in transferring, locomotion problem, PSI-subset 2-non-diagnoses, age <65, CPS	CMI
Proportion of residents with worse ADLs[1] long form score	Residents with worse ADL self-performance (ADL long-form score) as compared to prior assessment	Residents with valid assessments	Comatose, end of life	Not totally dependent in transferring, locomotion problem, PSI-subset 2-non-diagnoses, age <65	CMI
Proportion of residents who fell in the last 30 days	Residents who had a fall in the last 30 days on the current assessment	Residents with valid assessments	None	Not totally dependent in transferring, locomotion problem, PSI-subset 2-non-diagnoses, any wandering, unsteady gait/cognitive impairment, age <65	CMI

ADL=activities of daily living; CPS=cognitive performance scale, RUG=resource utilization group, CMI=case mix index, PSI=patient safety indicator

Table 12. Description of the variables included in the models

Variables	Definition
Control variables	
Facility size	Number of beds in the home • Medium: 30-99 beds • Large: 100+ beds **Note: Small homes (1-29 beds) were excluded from all analyses as the inherent small denominator for the QI calculation makes the estimate unstable*
Urban/rural	Classification of the surrounding area's population • Urban: >100 000 people in a metropolitan area • Rural: 10 000-100 000 people[21]
Health region	Classification of the surrounding areas provincial health region • Alberta has 5 health regions • British Columbia has 5 health regions • Manitoba has 1 health region • Ontario has 14 health regions
Neighbourhood income quintile	Classification of the surround neighbourhood's income: • lowest income quintile • 2nd quintile • 3rd quintile • 4th quintile • highest income quintile

QI=quality indicator

Table 12. (continued) Description of the variables included in the models

Variables	Definition
Explanatory variables	
Rehabilitation	
Physical therapy, occupational therapy, and speech language pathology*	• Number of residents receiving no PT, OT or SLP / number of assessments in home • Number of residents receiving PT, OT or SLP, < 45 minutes on < 3 days / number of assessments in home • Number of residents receiving PT, OT or SLP, 45 to 150 minutes on 3 to 5 days / number of assessments in home • Number of residents receiving PT, OT or SLP, > 150 minutes on > 5 days / number of assessments in home
Therapeutic recreation	Number of residents receiving therapeutic recreation (any amount) / number of assessments in home **Defined as services provided by a certified recreational therapist*
Nursing rehab	Number of residents receiving nursing rehab (any amount) / number of assessments in home **Defined as nursing interventions that assist or promote the resident's ability to attain their maximum functional potential*
Rehabilitation potential	
Self identified	Number of residents who self- identify as having potential to improve ADLs / number of assessments in home
Staff identified	Number of residents who staff identify as having potential to improve ADLs/ number of assessments in home

ADL=activities of daily living; PT=physical therapy; OT=occupational therapy; SLP=speech language pathology

**Note: PT, OT, and SLP were included in the models at the four indicated levels as these are the cut-points used in the Resource Utilization Guidelines for the Special Rehabilitation Group*

Table 12. (continued) Description of the variables included in the models

Variables	Definition
Rehabilitation potential (continued)	
Triggered activities of daily living clinical assessment protocol with potential to improve	Number of residents who triggered the activities of daily living clinical assessment protocol with potential to improve* / number of assessments in home * Criteria to trigger: • Receive at least some help in activities of daily living, but are not totally dependent • Cognitive performance scale score less than 6 (at least some minimal cognitive assets) • Are not at imminent risk of dying • Have two or more of the following: o Experiencing an acute episode or a flare-up of a chronic condition o Delirium o Changing cognitive status (either improving or worsening) o Pneumonia o Fall o Hip fracture o Recent hospitalization o Fluctuating activities of daily living (either improving or deteriorating) o Fluctuating care needs (with service supports either increasing or decreasing) o *Receiving physical therapy *this criterion has been removed*
Diagnoses	
Dementia	Number of residents with a diagnosis of dementia / number of assessments in home
Parkinson's disease	Number of residents with a diagnosis of Parkinson's disease / number of assessments in home
Stroke	Number of residents with a diagnosis of stroke / number of assessments in home
Multiple sclerosis	Number of residents with a diagnosis of multiple sclerosis / number of assessments in home
Hip fracture	Number of residents with a diagnosis of hip fracture / number of assessments in home
Other	
Physician visits	Number of residents who were visited by a physician at least twice in the last seven days / number of assessments in home
Acute care admissions	Number of residents admitted from acute care / number of assessments in home
Antipsychotic use	Number of residents who received at least one antipsychotic medication in the last seven days / number of assessments in home

RESULTS

The effective sample size was 914 homes, with most homes being large, in Ontario, and in urban centres (Table 13). In all provinces, most residents did not receive rehabilitation (PT, OT or SLP) between October 1st to December 31st, 2014, though Ontario had the highest median proportion of residents receiving rehabilitation (16.5% for less than 45 minutes over less than 3 days, and 32.9% for 45 to 150 minutes over 3 to 5 days) (Table 13). Overall, few residents received nursing rehab and even fewer received therapeutic recreation, with higher proportions found in Manitoba and Alberta, respectively. A description of the other explanatory variables is found in Table 13.

Table 13. Description of facility level variables by province

	Province									
	Alberta		British Columbia		Manitoba		Ontario		All	
Explanatory variable	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Number of homes	106	11.6	193	21.1	37	4.0	578	63.2	914	100.0
Size of home										
Medium	50	47.2	95	49.2	8	21.6	215	37.2	368	40.3
Large	56	52.8	98	50.8	29	78.4	363	62.8	546	59.7
Rurality										
Urban	75	70.8	176	91.2	37	100.0	457	79.1	745	81.5
Rural	31	29.2	17	8.8	0	0	121	20.9	169	18.5
Neighbourhood income quintile										
Lowest income quintile	27	25.5	64	33.2	14	37.8	135	23.4	240	26.3
2nd quintile	19	17.9	54	28.0	6	16.2	106	18.3	185	20.2
3rd quintile	26	24.3	27	14.0	5	13.5	124	21.4	182	19.9
4th quintile	23	21.7	29	15.0	4	10.8	113	19.5	169	18.5
Highest income quintile	11	10.4	19	9.8	8	21.6	100	17.2	138	15.1
Health Region										
Alberta – 31	7	6.6								
Alberta – 32	32	30.2								
Alberta – 33	23	21.7								
Alberta – 34	33	31.1								
Alberta – 35	11	10.4								
British Columbia – 60			44	22.8						
British Columbia – 61			57	29.5						
British Columbia – 62			43	22.3						
British Columbia – 63			46	23.8						
British Columbia – 64			3	1.6						
Manitoba – 10					37	100				

Table 13. (continued) Description of facility level variables by province

	Province									
	Alberta		British Columbia		Manitoba		Ontario		All	
Explanatory variable	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Health Region (continued)										
Ontario – 1							35	6.1		
Ontario – 2							66	11.4		
Ontario – 3							32	5.5		
Ontario – 4							84	14.5		
Ontario – 5							22	3.8		
Ontario – 6							26	4.5		
Ontario – 7							35	6.1		
Ontario – 8							46	8.0		
Ontario – 9							65	11.3		
Ontario – 10							36	6.2		
Ontario – 11							56	9.7		
Ontario – 12							26	4.5		
Ontario – 13							37	6.4		
Ontario – 14							12	2.1		

Table 13. (continued) Description of facility level variables by province

	Province									
	Alberta		British Columbia		Manitoba		Ontario		All	
Proportion of residents per home	***Median***	***1st, 3rd quartile***	***Median***	***1st, 3rd quartile***	***Median***	***1st, 3rd quartile***	***Median***	***1st, 3rd quartile***	***Median***	***1st, 3rd quartile***
Rehabilitation										
Receiving no PT, OT or SLP	61.8	40.4, 78.8	89.5	68.5, 97.6	93.8	89.8, 97.5	45.8	33.3, 56.0	52.6	38.3, 74.3
Receiving PT, OT or SLP, < 45 minutes on < 3 days	16.9	6.2, 30.1	4.8	1.1, 17.4	2.5	1.0, 4.6	16.5	6.8, 33.7	13.0	3.9, 28.6
Receiving PT, OT or SLP, 45 to 150 minutes on 3 to 5 days	15.2	7.2, 23.0	3.3	0, 11.3	2.6	0.5, 5.1	32.9	19.8, 44.6	22.0	7.1, 38.4
Receiving PT, OT or SLP, > 150 minutes on > 5 days	2.1	0, 7.5	0	0, 2.1	0	0, 1.0	0	0, 1.2	0	0, 1.6
Receiving therapeutic recreation (any amount)	30.9	5.5, 64.3	12.3	0.8, 46.1	1.2	0, 10.6	0	0, 3.2	0	0, 17.4
Receiving nursing rehab (any amount)	1.1	0, 5.6	5.3	1.3, 14.1	12.8	6.7, 23.1	10.5	3.6, 23.2	8.0	1.7, 18.7
	Mean	***SD***	***Mean***	***SD***	***Mean***	***SD***	***Mean***	***SD***	***Mean***	***SD***
Rehabilitation potential										
Self identified	12.30	8.93	14.12	8.26	7.61	4.62	10.95	11.28	11.64	10.34
Staff identified	9.85	9.17	9.55	7.00	5.05	3.02	8.60	9.98	8.80	9.17
Triggered ADL CAP	22.0	16.8	20.8	13.8	55.0	32.4	24.4	17.2	24.6	18.5
Diagnoses										
Dementia	53.21	13.66	53.05	13.91	54.75	7.79	52.30	10.61	52.66	11.66
Parkinson's disease	6.39	3.60	5.54	2.75	6.15	2.31	6.88	2.93	6.51	3.00
Stroke	19.54	7.00	20.50	7.89	21.76	6.42	21.72	6.59	21.21	6.96
Multiple sclerosis	3.26	4.43	1.72	2.05	1.85	2.29	1.45	1.34	1.73	2.19

PT=physical therapy; OT=occupational therapy; SLP=speech language pathology; ADL=activities of daily living; CAP=clinical assessment protocol

Table 13. (continued) Description of facility level variables by province

	Province									
	Alberta		British Columbia		Manitoba		Ontario		All	
Diagnoses (continued)										
Hip fracture	6.05	4.68	7.11	4.87	10.33	5.11	5.13	4.61	5.86	4.84
Other										
≥ 2 physician's visits in last 7 days	40.9	28.7	5.3	6.8	5.5	6.3	26.1	22.7	22.6	23.5
Admitted from acute care	50.98	23.86	38.02	24.88	40.81	22.26	45.11	20.45	44.11	22.23
Received an antipsychotic in last 7 days	25.4	11.8	33.9	10.7	23.0	7.0	30.1	8.9	30.1	10.0

Distribution of the quality indicators

Figure 7a shows the distribution of the QIs where a higher score on the QI reflects higher quality for each province for the fiscal quarter of January 1st to March 31st, 2015. Alberta performed better than the other provinces at improving late- and early-loss ADLs while Manitoba did not perform as well. Indeed, LTC homes in Alberta had the highest median (0.14) and 80th percentile (0.23) score for the proportion of residents with improved late-loss ADLs reflecting superior performance, while LTC homes in Manitoba had the lowest median (0.03) and 20th percentile (0.01) score reflecting worse performance (Figure 7a). A similar pattern was seen for early-loss ADLs (Figure 7a). Homes across all provinces had similar QI scores for improving mid-loss ADLs, though the difference between excellent and poor homes was the largest in Ontario. The median values for improved mid-loss ADLs were roughly similar across provinces (0.31), with Ontario having the largest spread between the 80th and 20th percentile homes (0.18 and 0.37) (Figure 7a).

Figure 7b shows the QIs where a lower score reflects higher quality. The results indicate that Manitoba LTC homes performed well at preventing mid- and late-loss ADL decline. However, they did not perform well for preventing early-loss ADL decline. Manitoba had the lowest 20th percentile and median values for the proportion of residents with worse late- (20th percentile=0.08, median=0.12) and mid-loss (20th percentile=0.2, median=0.27) ADLs and worse ADL long-form score (20th percentile=0.17, median=0.23) reflecting superior quality, but the highest 80th percentile (0.48) and median (0.41) values for worse early-loss

ADLs reflecting worse quality (Figure 7b). The median proportion of residents who fell in the last 30 days was the same across Alberta, British Columbia, and Ontario homes (0.15), while Manitoba homes' median (0.18) and 80th percentile (0.25) was higher than the other provinces (Figure 7b).

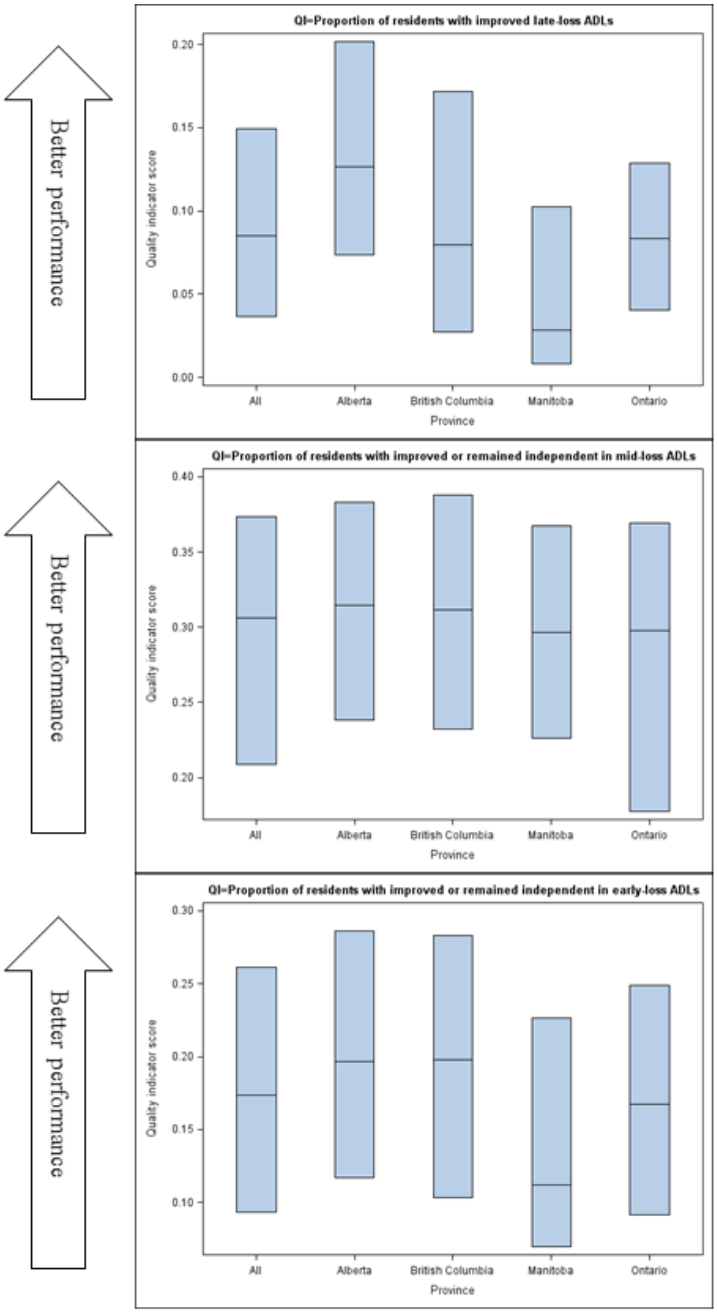

Figure 7a. Distribution of quality indicator scores, for quality indicators where a higher score indicates better performance

Note: The top of the box represents the 80th percentile, the bottom represents the 20th, and the centre bar represents the median

QI = quality indicator, ADL=Activities of daily living

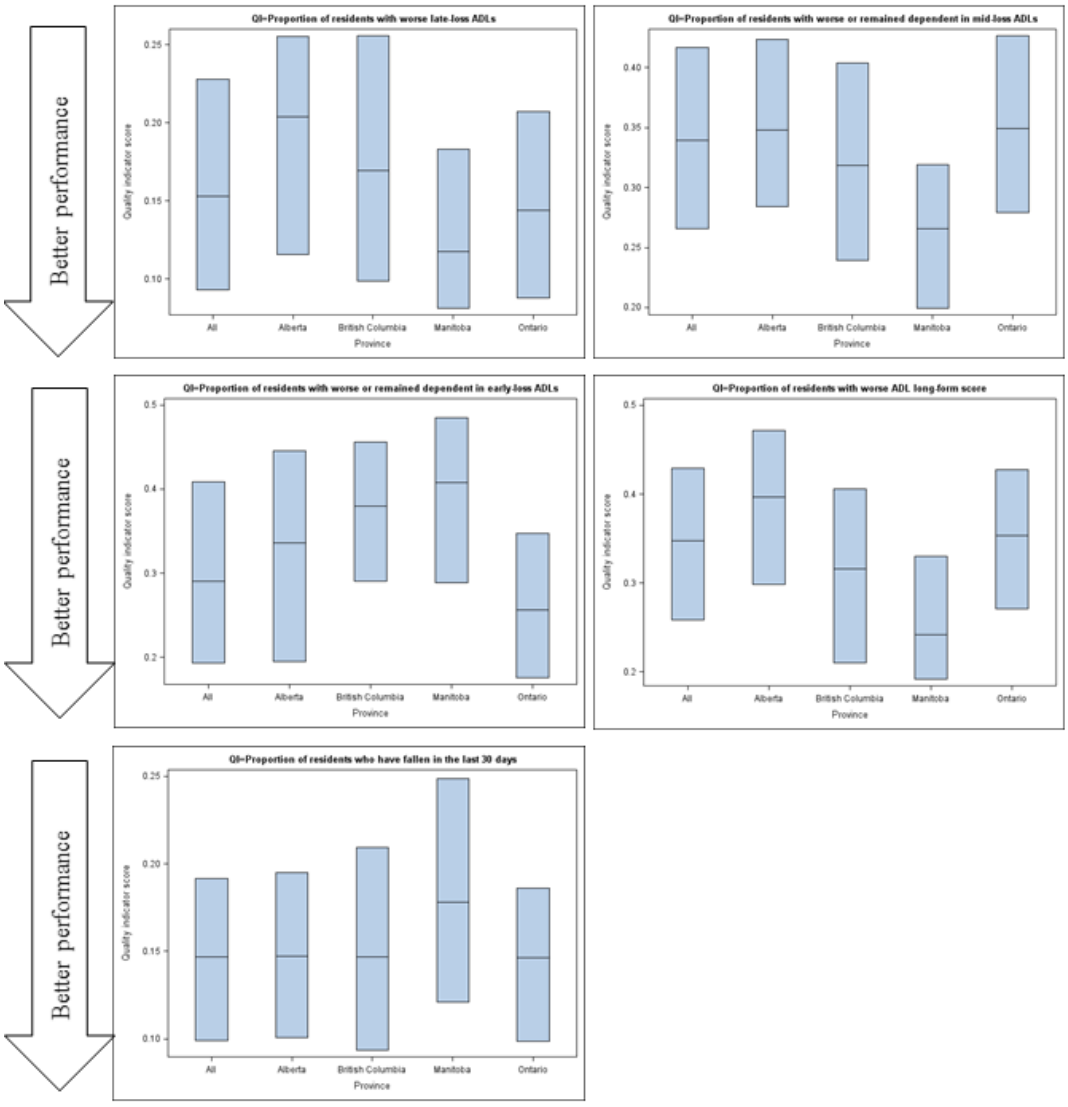

Figure 7b. Distribution of quality indicator scores, for quality indicators where a lower score indicates better performance

Note: The top of the box represents the 80th percentile, the bottom represents the 20th, and the centre bar represents the median

QI = quality indicator, ADL=Activities of daily living

Rehabilitation and the quality indicators

At the adjusted bivariate level ($p<0.2$), there was no consistent relationship with performance on the QIs and the proportion of residents receiving PT, OT, or SLP at any amount of service provision or in any province; in some instances, the association was positive and some it was negative and results varied by province and QI. For example, receiving no PT, OT, or SLP was negatively associated with an excellent rating on the QI measuring the proportion of residents with improved late-loss ADLs but only in Manitoba (Table 14a). Similarly, for the same QI receiving PT, OT, or SLP for less than 45 minutes over less than 3 days was positively associated with an excellent rating but this time in both Alberta and Manitoba (Table 14a). Though some provinces demonstrated more consistent relationships across the QIs and amount of rehabilitation provided at the bivariate level (e.g., Manitoba – Table 14a, 14b, 15a, 15b, 16a, 16b, 17a, 17b), once entered in the multivariable model the relationships did not remain statistically significant (Table 14c, 15c, 16c, 17c). Indeed, at the multivariable level, the proportion of residents receiving any amount of PT, OT, or SLP only remained statistically significant ($p<0.01$) for the QI measuring the proportion of residents who had fallen in the last 30 days in British Columbia, where the relationship was negative (Table 17c).

The proportion of residents receiving nursing rehab showed a more consistent relationship with performance on the QIs, though still fluctuating between positive and negative associations across the provinces and QIs. A consistent relationship was especially true for prevention of ADL decline in Alberta,

where nursing rehab remained in the multivariable models and had a positive association with excellent performance for four of the QIs: the proportion of residents with worse late- (Table 14c), mid- (Table 15c), and early-loss (Table 16c) ADLs, and overall ADL decline (Table 17c). The relationship between the QIs and the proportion of residents receiving therapeutic recreation also was inconsistent, and never remained in any multivariable model (Table 14c, 15c, 16c, 17c).

Measures of rehabilitation potential, such as the proportion of residents who self-identified as having the potential to improve, were also inconsistently associated with the QIs across provinces (Table 15a, 15b, 16a, 16b, 17a, 17b). The only rehabilitation potential variable that remained statistically significant ($p<0.01$) in a multivariable model was the proportion of residents who triggered the ADL CAP with the potential to improve in Alberta in relation to the QI measuring the proportion of residents with improved late-loss ADLs (Table 14c).

Other facility-level factors associated with the quality indicators

The diagnoses that were most consistently associated with the QIs were the proportion of residents with hip fracture and multiple sclerosis both in the bivariate and multivariable models and across provinces. In the multivariable models, the proportion of residents with hip fracture was significantly ($p<0.01$) associated with the proportion of residents with improved late-loss ADLs in British Columbia (Table 14c), improved mid-loss ADLs in Ontario and British Columbia (Table 15c), improved early-loss ADLs in British Columbia (Table

16c), worse early-loss ADLs in Alberta (Table 16c), and worse overall ADL long-form score in British Columbia (Table 17c). The relationship between the proportion of residents with hip fracture and excellent performance on the QIs was positive, except for the proportion of residents with worse early-loss ADLs in Alberta (Table 16c). In the multivariable models, the proportion of residents with multiple sclerosis was significantly ($p<0.01$) associated with the proportion of residents with worse late-loss ADLs in Alberta and British Columbia (Table 14b), worse early-loss ADLs in Alberta (Table 16b), and who fell within the last 30 days in British Columbia (Table 17b). The association between the proportion of residents with multiple sclerosis and the QIs was positive for the QIs measuring the proportion of residents who fell (Table 17c) and had worse late-loss ADLs in British Columbia (Table 14c), but negative for the both the proportion of residents with worse and improved early-loss ADLs (Table 16c) and worse late-loss ADLs in Alberta (Table 14c).

In the final multivariable models, additional facility-level factors that were significantly ($p<0.01$) associated with the QIs were the proportion of residents who were admitted from acute care in Manitoba (Table 14c and 17c - negatively associated with excellent performance in the falls QI and the proportion of residents with improved late-loss ADLs), the proportion of residents who received an antipsychotic in the last week in Ontario (Table 14c - negatively associated with excellent performance in the proportion of residents with improved late-loss ADLs), and the proportion of residents who had at least two physicians' visits in the past week in British Columbia (Table 17c - positively

associated with the excellent performance in the proportion of residents with worse late-loss ADLs).

Table 14a. Stratified bivariate estimates for the quality indicator measuring the proportion of residents with improved late loss activities of daily living (modelling the odds of being "excellent")

	Proportion of residents with improved late loss ADLs			
	Alberta†	Ontario†	BC[2†]	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	-0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	-0.06 (0.04)*
Receiving PT, OT or SLP, < 45 minutes on < 3 days	0.02 (0.01)*	0.00 (0.00)	0.00 (0.01)	0.23 (0.14)*
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	-0.02 (0.02)	0.00 (0.01)	0.00 (0.01)	0.00 (0.07)
Receiving PT, OT or SLP, > 150 minutes on > 5 days	0.01 (0.02)	0.03 (0.03)	-0.01 (0.02)	-0.04 (0.33)
Receiving therapeutic recreation (any amount)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.01 (0.03)
Receiving nursing rehab (any amount)	0.00 (0.02)	0.01 (0.01)*	0.01 (0.01)*	0.02 (0.02)
Rehabilitation potential				
Self- identify as having potential to improve ADLs	-0.02 (0.02)	0.00 (0.01)	0.03 (0.02)*	0.22 (0.09)*
Staff identify as having potential to improve ADLs	0.01 (0.02)	0.00 (0.01)	0.02 (0.02)	0.17 (0.13)*
Triggered ADL CAP with potential to improve	0.05 (0.01)*	0.00 (0.01)	0.00 (0.01)	-0.02 (0.01)
Diagnoses				
Dementia	0.02 (0.02)*	0.00 (0.01)	0.00 (0.01)	0.12 (0.05)*
Parkinson's disease	0.15 (0.06)*	0.01 (0.03)	0.01 (0.05)	0.04 (0.15)
Stroke	-0.01 (0.03)	0.01 (0.01)	0.01 (0.02)	-0.02 (0.06)
Multiple Sclerosis	-0.10 (0.06)*	-0.03 (0.07)	0.07 (0.07)	-0.14 (0.13)
Hip fracture	0.00 (0.05)	0.03 (0.02)	0.10 (0.03)*	0.15 (0.08)*
Other				
≥ 2 physician's visits in last 7 days	0.02 (0.01)*	0.00 (0.00)	0.00 (0.02)	0.06 (0.06)
Admitted from acute care	-0.01 (0.01)	-0.01 (0.01)*	0.00 (0.01)	-0.08 (0.02)*
Received an antipsychotic in last 7 days	-0.04 (0.02)*	-0.03 (0.01)*	0.03 (0.01)*	0.06 (0.06)

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 14b. Stratified bivariate estimates for the quality indicator measuring the proportion of residents with worse late loss activities of daily living (modelling the odds of being "excellent")

	Proportion of residents with worse late loss ADLs			
	Alberta†	Ontario†	BC[2]†	Manitoba† †
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	-0.03 (0.04)
Receiving PT, OT or SLP, < 45 minutes on < 3 days	-0.01 (0.01)	-0.01 (0.01)*	0.00 (0.01)	0.26 (0.10)*
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	-0.02 (0.02)	0.00 (0.01)	0.00 (0.01)	-0.12 (0.07)*
Receiving PT, OT or SLP, > 150 minutes on > 5 days	0.00 (0.02)	0.05 (0.03)*	0.02 (0.02)	-0.49 (0.31)*
Receiving therapeutic recreation (any amount)	0.00 (0.01)	0.00 (0.01)	0.0 (0.01)	0.03 (0.03)*
Receiving nursing rehab (any amount)	0.04 (0.02)*	0.00 (0.01)	0.01 (0.01)*	0.01 (0.02)
Rehabilitation potential				
Self- identify as having potential to improve ADLs	-0.01 (0.02)	0.00 (0.01)	0.03 (0.02)*	0.09 (0.08)
Staff identify as having potential to improve ADLs	-0.01 (0.02)	0.00 (0.01)	0.02 (0.02)	0.12 (0.12)
Triggered ADL CAP with potential to improve	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)*	-0.01 (0.01)
Diagnoses				
Dementia	0.01 (0.02)	0.00 (0.01)	0.00 (0.01)	0.02 (0.04)
Parkinson's disease	0.05 (0.06)	0.02 (0.03)	0.01 (0.05)	0.03 (0.14)
Stroke	0.06 (0.03)*	0.03 (0.01)*	0.03 (0.02)*	0.05 (0.07)
Multiple Sclerosis	-0.10 (0.05)*	0.02 (0.06)	0.26 (0.07)*	-0.15 (0.14)
Hip fracture	0.00 (0.04)	0.00 (0.02)	0.06 (0.03)*	0.21 (0.09)*
Other				
≥ 2 physician's visits in last 7 days	-0.01 (0.01)	0.00 (0.00)	0.03 (0.02)*	0.01 (0.06)
Admitted from acute care	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	-0.02 (0.02)
Received an antipsychotic in last 7 days	-0.03 (0.03)*	0.00 (0.01)	0.00 (0.01)	0.06 (0.05)

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 14c. Final stratified estimates for the quality indicator measuring the proportion of residents with improved and worse late loss activities of daily living (modelling the odds of being "excellent") (p<0.01)

	Proportion of residents with improved late loss ADLs				Proportion of residents with worse late loss ADLs			
	Alberta†	Ontario†	BC[2]†	Manitoba††	Alberta†	Ontario†	BC[2]†	Manitoba† †
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Receiving nursing rehab (any amount)					0.06 (0.02)			
triggered ADL[1] CAP[3] with potential to improve	0.05 (0.02)							
Multiple Sclerosis					-0.18 (0.07)		0.03 (0.08)	
Hip fracture			0.10 (0.03)					
Admitted from acute care				-0.07 (0.02)				
Received an antipsychotic in last 7 days		-0.03 (0.01)						

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 15a. Stratified bivariate estimates for the quality indicator measuring the proportion of residents with improved mid loss activities of daily living (modelling the odds of being "excellent")

	Proportion of residents with improved or remained independent in mid loss ADLs			
	Alberta†	Ontario†	BC[2]†	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	-0.01 (0.01)*	0.00 (0.00)	0.01 (0.01)	0.03 (0.05)
Receiving PT, OT or SLP, < 45 minutes on < 3 days	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	-0.04 (0.07)
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	0.02 (0.02)*	0.00 (0.01)	-0.02 (0.02)	-0.03 (0.30)
Receiving PT, OT or SLP, > 150 minutes on > 5 days	0.04 (0.02)*	-0.01 (0.03)	-0.03 (0.02)	-0.14 (0.03)
Receiving therapeutic recreation (any amount)	0.00 (0.01)	-0.01 (0.01)*	0.00 (0.01)	-0.03 (0.02)
Receiving nursing rehab (any amount)	-0.01 (0.02)	-0.01 (0.00)*	-0.01 (0.01)	0.01 (0.01)
Rehabilitation potential				
Self- identify as having potential to improve ADLs	0.02 (0.02)	-0.02 (0.01)*	-0.02 (0.02)	-0.04 (0.08)
Staff identify as having potential to improve ADLs	0.03 (0.02)	-0.01 (0.01)*	0.00 (0.02)	-0.18 (0.13)*
Triggered ADL CAP with potential to improve	-0.03 (0.01)*	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Diagnoses				
Dementia	-0.01 (0.02)	-0.01 (0.01)	0.02 (0.01)*	-0.12 (0.05)*
Parkinson's disease	-0.06 (0.06)	-0.04 (0.03)*	-0.08 (0.06)*	0.07 (0.16)
Stroke	-0.02 (0.03)	-0.02 (0.01)*	-0.05 (0.02)*	0.01 (0.06)
Multiple Sclerosis	0.05 (0.05)	0.11 (0.06)*	-0.16 (0.08)*	-0.01 (0.15)
Hip fracture	-0.02 (0.05)	0.02 (0.02)	-0.07 (0.04)*	-0.26 (0.10)*
Other				
≥ 2 physician's visits in last 7 days	0.01 (0.01)*	0.00 (0.00)	-0.04 (0.03)*	0.09 (0.07)
Admitted from acute care	0.02 (0.01)*	0.00 (0.00)	-0.01 (0.01)*	0.03 (0.02)*
Received an antipsychotic in last 7 days	-0.01 (0.02)*	0.01 (0.01)	0.03 (0.02)*	-0.04 (0.06)

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 15b. Stratified bivariate estimates for the quality indicator measuring the proportion of residents with worse mid loss activities of daily living (modelling the odds of being "excellent")

	Proportion of residents with worse or remained dependent in mid loss ADLs			
	Alberta†	Ontario†	BC2†	Manitoba† †
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	0.00 (0.01)	0.00 (0.00)	0.00 (0.01)	-0.06 (0.04)*
Receiving PT, OT or SLP, < 45 minutes on < 3 days	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	0.14 (0.09)*
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	-0.01 (0.02)	0.00 (0.00)	-0.01 (0.02)	0.01 (0.07)
Receiving PT, OT or SLP, > 150 minutes on > 5 days	-0.01 (0.02)	0.01 (0.03)	0.01 (0.02)	-0.01 (0.31)
Receiving therapeutic recreation (any amount)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	0.02 (0.02)
Receiving nursing rehab (any amount)	0.06 (0.02)*	0.00 (0.00)	0.01 (0.01)*	0.03 (0.02)*
Rehabilitation potential				
Self- identify as having potential to improve ADLs	0.00 (0.02)	0.01 (0.01)	0.05 (0.02)*	0.11 (0.09)*
Staff identify as having potential to improve ADLs	0.05 (0.02)*	0.01 (0.01)*	0.04 (0.02)*	0.01 (0.13)
Triggered ADL CAP with potential to improve	0.03 (0.01)*	0.00 (0.01)	0.02 (0.01)	-0.01 (0.01)
Diagnoses				
Dementia	-0.01 (0.02)	0.01 (0.01)	0.00 (0.01)	0.03 (0.05)
Parkinson's disease	-0.02 (0.06)	0.05 (0.03)*	-0.02 (0.05)	-0.14 (0.15)
Stroke	0.08 (0.03)*	0.01 (0.01)	-0.02 (0.02)	-0.06 (0.07)
Multiple Sclerosis	0.10 (0.05)*	0.06 (0.06)	0.10 (0.07)*	0.10 (0.16)
Hip fracture	0.13 (0.05)*	0.05 (0.02)*	0.09 (0.03)*	0.01 (0.07)
Other				
≥ 2 physician's visits in last 7 days	0.01 (0.01)	0.01 (0.00)	0.02 (0.02)	0.06 (0.07)
Admitted from acute care	0.01 (0.01)*	0.00 (0.00)	0.00 (0.01)	0.00 (0.02)
Received an antipsychotic in last 7 days	-0.01 (0.02)	-0.01 (0.01)	0.02 (0.01)	0.03 (0.05)

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 15c. Final stratified estimates for the quality indicator measuring the proportion of residents with improved and worse mid loss activities of daily living (modelling the odds of being "excellent") (p <0.01)

	Proportion of residents with worse or remained dependent in mid loss ADLs			
	Alberta†	Ontario†	BC[2†]	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Receiving nursing rehab (any amount)	0.06 (0.02)			
Hip fracture		0.09 (0.02)	0.05 (0.04)	

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 16a. Stratified bivariate estimates for the quality indicator measuring the proportion of residents with improved early loss activities of daily living (modelling the odds of being "excellent")

	Proportion of residents with improved or remained independent in early loss ADLs			
	Alberta†	Ontario†	BC[2†]	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	0.01 (0.01)*	0.00 (0.00)	0.00 (0.01)	0.02 (0.03)
Receiving PT, OT or SLP, < 45 minutes on < 3 days	-0.02 (0.01)	0.00 (0.00)	0.00 (0.01)	0.00 (0.04)
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	-0.01 (0.02)	0.00 (0.01)	-0.02 (0.02)*	-0.08 (0.07)
Receiving PT, OT or SLP, > 150 minutes on > 5 days	-0.03 (0.02)*	-0.05 (0.03)*	-0.02 (0.02)	0.20 (0.31)
Receiving therapeutic recreation (any amount)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.02 (0.02)
Receiving nursing rehab (any amount)	-0.03 (0.02)*	-0.01 (0.00)*	-0.01 (0.01)*	0.00 (0.02)
Rehabilitation potential				
Self- identify as having potential to improve ADLs	-0.03 (0.02)	-0.01 (0.01)	-0.01 (0.02)	-0.11 (0.08)*
Staff identify as having potential to improve ADLs	-0.02 (0.02)	-0.01 (0.01)	0.00 (0.02)	-0.11 (0.12)
Triggered ADL CAP with potential to improve	-0.02 (0.01)*	0.00 (0.01)	-0.01 (0.01)	0.02 (0.01)*
Diagnoses				
Dementia	0.01 (0.02)	-0.01 (0.01)*	0.01 (0.01)	-0.08 (0.05)*
Parkinson's disease	-0.05 (0.06)	-0.02 (0.03)	-0.01 (0.05)	-0.12 (0.15)
Stroke	-0.01 (0.03)	-0.02 (0.01)*	-0.04 (0.02)*	-0.07 (0.06)
Multiple Sclerosis	0.02 (0.05)	0.03 (0.06)	-0.21 (0.08)*	-0.08 (0.15)
Hip fracture	0.03 (0.05)	-0.04 (0.02)*	-0.09 (0.03)*	-0.15 (0.08)*
Other				
≥ 2 physician's visits in last 7 days	-0.02 (0.01)*	-0.01 (0.00)*	-0.02 (0.02)	0.03 (0.08)
Admitted from acute care	0.01 (0.01)	0.00 (0.00)	-0.01 (0.01)*	0.04 (0.02)*
Received an antipsychotic in last 7 days	0.04 (0.02)*	0.01 (0.01)	0.00 (0.01)	-0.06 (0.05)

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 16b. Stratified bivariate estimates for the quality indicator measuring the proportion of residents with worse early loss activities of daily living (modelling the odds of being "excellent")

	Proportion of residents with worse or remained dependent in early loss ADLs			
	Alberta†	Ontario†	BC[2†]	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	0.01 (0.01)*	0.00 (0.00)	0.00 (0.01)	-0.15 (0.07)*
Receiving PT, OT or SLP, < 45 minutes on < 3 days	-0.01 (0.01)	0.00 (0.00)	-0.01 (0.01)	0.38 (0.20)*
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	-0.04 (0.02)*	0.00 (0.01)	0.00 (0.02)	0.14 (0.10)*
Receiving PT, OT or SLP, > 150 minutes on > 5 days	0.01 (0.02)	-0.02 (0.03)	0.02 (0.02)	0.34 (0.33)
Receiving therapeutic recreation (any amount)	0.00 (0.01)	-0.01 (0.01)	0.01 (0.01)*	0.05 (0.04)*
Receiving nursing rehab (any amount)	0.03 (0.02)*	0.00 (0.00)	0.01 (0.01)	0.01 (0.02)*
Rehabilitation potential				
Self- identify as having potential to improve ADLs	0.01 (0.02)	0.00 (0.01)	0.02 (0.02)	0.30 (0.12)
Staff identify as having potential to improve ADLs	-0.01 (0.02)	0.00 (0.01)	0.01 (0.02)	0.26 (0.15)*
Triggered ADL CAP with potential to improve	0.02 (0.01)*	-0.01 (0.01)*	0.01 (0.01)	0.00 (0.01)
Diagnoses				
Dementia	0.02 (0.01)*	0.01 (0.01)*	0.00 (0.01)	0.07 (0.06)*
Parkinson's disease	0.07 (0.06)*	0.02 (0.03)	-0.05 (0.05)	0.20 (0.18)
Stroke	0.02 (0.03)	0.03 (0.01)*	0.00 (0.02)	0.00 (0.07)
Multiple Sclerosis	-0.11 (0.04)*	-0.03 (0.07)	0.12 (0.08)*	0.06 (0.19)
Hip fracture	-0.09 (0.04)*	-0.01 (0.02)	0.03 (0.03)	0.00 (0.08)
Other				
≥ 2 physician's visits in last 7 days	-0.01 (0.01)	0.00 (0.00)	0.01 (0.02)	-0.02 (0.07)
Admitted from acute care	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	-0.01 (0.02)
Received an antipsychotic in last 7 days	-0.05 (0.02)*	-0.02 (0.01)*	-0.01 (0.02)	0.12 (0.07)*

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 16c. Final stratified estimates for the quality indicator measuring the proportion of residents with improved and early loss activities of daily living (modelling the odds of being "excellent") (p <0.01)

	Proportion of residents with improved or remained independent in early loss ADLs				Proportion of residents with worse or remained dependent in early loss ADLs			
	Alberta†	Ontario†	BC[2†]	Manitoba††	Alberta†	Ontario†	BC[2†]	Manitoba† †
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Receiving nursing rehab (any amount)					0.06 (0.02)			
Multiple Sclerosis			-0.22 (0.08)		-0.19 (0.07)			
Hip fracture			-0.1 (0.04)					

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 17a. Stratified bivariate estimates for the quality indicator measuring the proportion of residents with worse overall activities of daily living (modelling the odds of being "excellent")

	Proportion of residents with worse ADLs long form score			
	Alberta†	Ontario†	BC[2†]	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	0.00 (0.01)	0.00 (0.00)	-0.01 (0.01)	-0.12 (0.06)*
Receiving PT, OT or SLP, < 45 minutes on < 3 days	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	0.28 (0.13)*
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	-0.02 (0.02)	0.00 (0.01)	0.01 (0.01)	0.09 (0.08)
Receiving PT, OT or SLP, > 150 minutes on > 5 days	0.00 (0.02)	0.04 (0.03)*	0.04 (0.03)*	0.22 (0.35)
Receiving therapeutic recreation (any amount)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	0.03 (0.03)
Receiving nursing rehab (any amount)	0.06 (0.02)*	0.00 (0.00)	0.02 (0.01)*	0.01 (0.02)
Rehabilitation potential				
Self- identify as having potential to improve ADLs	0.00 (0.02)	0.00 (0.01)	0.04 (0.02)*	0.23 (0.10)*
Staff identify as having potential to improve ADLs	0.00 (0.02)	0.01 (0.01)*	0.02 (0.02)	0.07 (0.12)
Triggered ADL CAP with potential to improve	0.02 (0.01)*	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Diagnoses				
Dementia	0.00 (0.02)	0.00 (0.01)	-0.03 (0.01)*	0.05 (0.05)
Parkinson's disease	0.05 (0.06)	0.02 (0.03)	0.01 (0.05)	-0.15 (0.16)
Stroke	0.03 (0.03)	0.02 (0.01)*	0.00 (0.02)	0.00 (0.06)
Multiple Sclerosis	-0.04 (0.05)	0.03 (0.07)	0.07 (0.07)	0.09 (0.16)
Hip fracture	-0.01 (0.05)	0.04 (0.02)*	0.10 (0.03)*	0.15 (0.09)*
Other				
≥ 2 physician's visits in last 7 days	0.01 (0.01)	0.00 (0.00)	0.08 (0.03)*	0.12 (0.08)
Admitted from acute care	-0.01 (0.01)	0.01 (0.00)*	0.01 (0.01)	-0.03 (0.02)*
Received an antipsychotic in last 7 days	-0.03 (0.02)	-0.01 (0.01)	0.03 (0.01)*	0.10 (0.06)*

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 17b. Stratified bivariate estimates for the quality indicator measuring the proportion of residents who have fallen in the last 30 days (modelling the odds of being "excellent")

	Proportion of residents who have fallen in the last 30 days			
	Alberta†	Ontario†	BC[2]†	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Rehabilitation				
Receiving no PT, OT or SLP	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	-0.04 (0.04)
Receiving PT, OT or SLP, < 45 minutes on < 3 days	-0.01 (0.01)	-0.01 (0.00)	-0.02 (0.01)*	-0.02 (0.05)
Receiving PT, OT or SLP, 45 to 150 minutes, 3 to 5 days	-0.03 (0.02)*	0.01 (0.01)	0.02 (0.01)*	0.13 (0.08)*
Receiving PT, OT or SLP, > 150 minutes on > 5 days	0.02 (0.02)	0.01 (0.03)	0.06 (0.03)*	0.74 (0.36)*
Receiving therapeutic recreation (any amount)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.04 (0.03)*
Receiving nursing rehab (any amount)	0.02 (0.02)*	0.01 (0.00)*	0.00 (0.01)	0.01 (0.02)
Rehabilitation potential				
Self- identify as having potential to improve ADLs	-0.03 (0.02)	0.02 (0.01)*	0.03 (0.02)*	0.04 (0.08)
Staff identify as having potential to improve ADLs	-0.04 (0.02)*	0.03 (0.01)*	0.03 (0.02)*	-0.03 (0.12)
Triggered ADL CAP with potential to improve	0.00 (0.01)	-0.01 (0.01)*	0.01 (0.01)	0.02 (0.01)*
Diagnoses				
Dementia	-0.04 (0.02)*	0.00 (0.01)	0.00 (0.01)	-0.04 (0.05)
Parkinson's disease	-0.09 (0.06)	0.02 (0.03)	-0.05 (0.05)	0.07 (0.16)
Stroke	-0.03 (0.03)	0.02 (0.01)*	0.03 (0.02)*	-0.03 (0.06)
Multiple Sclerosis	0.15 (0.06)*	-0.05 (0.07)	0.19 (0.08)*	0.18 (0.16)
Hip fracture	-0.02 (0.05)	0.00 (0.02)	0.07 (0.03)*	-0.11 (0.08)*
Other				
≥ 2 physician's visits in last 7 days	0.00(0.01)	0.01(0.00)	0.02 (0.02)	0.03 (0.06)
Admitted from acute care	0.00 (0.01)	0.00 (0.00)	0.00 (0.01)	-0.04 (0.02)*
Received an antipsychotic in last 7 days	0.00 (0.02)	-0.02 (0.01)*	-0.02 (0.01)	0.07 (0.06)

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

Table 17c. Final stratified estimates for the quality indicator measuring the proportion of residents with worse overall activities of daily living and who have fallen in the last 30 days (modelling the odds of being "excellent")

	Proportion of residents with worse ADLs long form score				Proportion of residents who have fallen in the last 30 days			
	Alberta†	Ontario†	BC[2]†	Manitoba††	Alberta†	Ontario†	BC[2]†	Manitoba††
Parameter (proportion of residents per home)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Receiving PT[3], OT[4] or SLP[5], < 45 minutes on < 3 days							-0.03 (0.02)	
Receiving nursing rehab (any amount)	0.06 (0.02)							
Dementia			-0.03 (0.01)					
Multiple Sclerosis							0.23 (0.08)	
Hip fracture			0.10 (0.04)					
≥ 2 physician's visits in last 7 days			0.07 (0.03)					
Admitted from acute care								-0.15 (0.08)

ADLs=activities of daily living; BC=British Columbia; physical therapy; occupational therapy; speech language pathology; clinical assessment protocol.

† adjusted for health region, facility size, income quintile, and rurality; †† adjusted for income quintile; *P<0.2

DISCUSSION

Our study reveals that the median, and 20th and 80th percentile scores for the ADL and falls QI varied widely across the four provinces. The proportion of residents receiving rehabilitation services within LTC homes was not consistently associated with performance on the ADL and falls QIs. However, the proportion of residents receiving nursing rehab services in Alberta was consistently positively associated with improved performance on prevention of ADL decline QIs. Additionally, the proportion of residents with multiple sclerosis and hip fracture were often associated with QI performance. The association was positive or negative depending on the QI and the province. Given that our study was conducted and analyzed at the facility-level, the results must be interpreted with caution. Indeed, the study could be subject to ecological fallacy if the observations made at the facility-level are interpreted at the resident-level.[73] That is, the lack of an association between the proportion of residents receiving rehabilitation and performance on the QIs does not translate to a lack of improvement in ADLs for residents who receive these services. Rather, the results of our study should be used to generate hypotheses and consider the effect of context on ADL improvement or decline.[74]

The QIs varied widely across the four provinces included in our study. The variation may reflect the diversity in the population of LTC homes across Canada, or it may be a result of different provincial rehabilitation practices.

Alberta, Manitoba, and British Columbia have introduced assisted living and supportive housing initiatives as alternatives to LTC.[75,76] Additionally, Ontario has complex continuing care hospitals where younger, more medically unstable older adults reside.[15] Therefore, the characteristics of residents in LTC homes may vary due to system-level policies. Indeed, on average 55% of residents in Manitoba LTC homes triggered the ADL CAP in our study. Comparatively, only 20-25% of residents triggered the ADL CAP in the other three provinces, indicating that residents in Manitoba LTC homes may have greater health fluctuations and therefore a higher potential for improvement. This may explain why Manitoba performs better on QIs measuring early- and late-loss ADL decline. Differences in provincial policies for providing rehabilitation in LTC homes may also help explain the variation in QIs across provinces. For example, in British Columbia older adults can receive $23 per visit for up to 10 visits from a physiotherapist, while Alberta and Manitoba provide a mix of both private and public funding for rehabilitation services.[77-79] Residents in provinces with publicly funded models of rehabilitation delivery may be more likely to receive services and therefore more likely to improve.

Contrary to our hypothesis, the proportion of residents receiving rehabilitation services within LTC homes was not consistently associated with improved performance on ADL and falls QIs. These findings have significant implications for practice, especially for provinces like Ontario that provide rehabilitation to a higher proportion of residents. Several intervention trials in LTC have shown change in facility-level QIs in response to an intervention.[51,80,81] However, like

our study, none have shown improvement in ADL QIs to date. Higher rates of rehabilitation were associated with a lower prevalence of bedridden residents and residents with little or no activity (as measured by a RAI-MDS QI) in Finnish LTC homes.[58] Yet, in an American study, no quality measures correlated with any rehabilitation outcomes.[57] A lack of association between the proportion of residents receiving rehabilitation and QI performance at the facility-level is in contrast with clinical trials demonstrating rehabilitation can improve ADL performance at the resident level,[12] suggesting that current implementation of rehabilitation may not be sufficient to induce change, or that ADL QIs are not responsive. International researchers have questioned the effective implementation of rehabilitation services in LTC. Indeed, a 2017 report by a task force of international clinician researchers recommends reframing LTC care with the purpose of addressing the lack of precision in rehabilitation, indicating that current practices may result in a failure to preserve or reduce loss of function.[82] The model of rehabilitation delivery, the elements of the interventions, and the targeting of rehabilitation services at the time of the current analysis may not have been be optimal in the Canadian LTC context.

The model of delivery of rehabilitation services in Canadian LTC homes may influence the relationship between the proportion of residents receiving rehabilitation and the QIs. For example, most rehabilitation in Ontario LTC homes is provided in a delegated care model, where a physical therapist completes an assessment and delegates the provision of the intervention to an assistant or aide. In fact, in 2010 only 7.7% of rehabilitation in Ontario LTC

homes was provided by registered physical therapists with the remaining 92.3% was provided by therapy aides.[83] In contrast, in complex continuing care facilities who have a slightly younger, more clinically complex population, 63.3% of care was provided by physical therapists.[80] Additionally, less than 5% of intervention studies used a delegated care model as their intervention (See Chapter 3). Thus, current practice is not following best evidence.

Rehabilitation is also not the sole responsibility of the rehabilitation staff, such as PT and OT. To promote achievement and carry-over of strength and functional gains via rehabilitation, nursing staff need to encourage functional independence for prevention of further decline. For example, an intervention where healthcare aides encouraged residents to perform sit to stands throughout the day demonstrated maintenance of mobility and a slower functional decline compared to residents in the control group.[84] Therefore, integration of rehabilitation into daily care practices may improve functional outcomes such as ADLs. However, this integration is not captured by the RAI-MDS in the proportion of residents receiving rehabilitation. Consequently, if some homes are already doing this but others are not this might explain the variability in QIs across homes and why the amount of rehabilitation provided is not related to QI performance.

On the other hand, the elements of the rehabilitation intervention could be the reason for the lack of association between the proportion of residents receiving rehabilitation and the facility-level ADL and falls QIs. Rehabilitation services that are low-intensity may not sufficiently address physical function

impairments or performance, can encourage inactivity, and may further perpetuate functional decline.[82,85] Indeed, multicomponent exercise programs involving strength training are most effective for preventing disability and other adverse events.[86] A limitation of the current study is that we were only able to glean the amount of rehabilitation provided in terms of minutes and days per week, rather than the elements of the rehabilitation intervention, such as the therapeutic goals of treatment. However, most residents received no PT, OT, or SLP, while the highest proportions of residents who did receive services were in the least time intensive category (i.e., for less than 45 minutes over less than 3 days). Additionally, very small proportions of residents received time intensive services in all provinces. In contrast, a systematic review by Crocker et al.[12] found that rehabilitation sessions lasting between 45 to 75 minutes delivered 2 to 3 times per week had a small positive effect on resident's ADLs. Further, some residents may receive care from PT or OT only for assessment and prescription for mobility aides such as walkers or wheelchairs. There would be limited effect on ADLs or falls for these residents. Though time dedicated to treatment does not necessarily translate to the intensity of the intervention, it may be that in current practice there is insufficient time to reach an appropriate intensity of rehabilitation to result in improvement in ADLs and falls QIs. Certainly, most residents in Canadian LTC homes are not receiving 45-minute sessions 3 times per week.[8]

Another reason why the benefits of rehabilitation may not be realized is that services may not be appropriately targeted to residents who have the potential to

improve. In our study, the proportion of residents who triggered the ADL CAP with the potential to improve was only associated with the QI measuring the proportion of residents with improved late-loss ADLs in Alberta. Additionally, LTC homes in Alberta had the highest 80th percentile value across all provinces for the same QI. Thus, perhaps LTC homes in Alberta are targeting rehabilitation services to residents who have the potential to improve, and are therefore seeing a higher proportion of residents improve in their ADLs. Conversely, Ontario LTC homes use the older version of the CAPs called the Resident Assessment Protocols (RAPs). The RAPs use a different set of items from the CAPs to indicate which residents have the potential to improve. While the ADL CAP triggers for residents with fluctuating health conditions (see Table 10)[87], the ADL RAP triggers for residents who are not independent in one or more ADL (e.g., bed mobility, transferring, walking, dressing, eating, toilet use).[88] Arguably, most residents are dependent in at least one ADL or they would not reside in LTC. Therefore, the ADL RAP would trigger for most residents while the ADL CAP only triggers for 14 to 31 percent of the LTC population who have the potential to improve.[15] Subsequently, provinces that provide a large proportion of residents with rehabilitation, such as Ontario, may not be appropriately targeting services to residents who have the potential to improve since the tool they use to identify residents with rehabilitation potential may lack sensitivity.

The only statistically significant relationship between QI performance and proportion of residents receiving rehabilitation was observed in British

Columbia for the falls QI, where the relationship was negative. This finding is consistent with other literature to date demonstrating mixed results for clinical trials of exercise in LTC to prevent falls.[89] Indeed, current recommendations for fall and fracture prevention in LTC suggest exercise should only be included as part of a multifactorial intervention.[89,90] Given the cross-sectional nature of our study it is difficult to discern the relationship between rehabilitation and falls. Residents could have been referred to rehabilitation because of recent falls or an identified falls risk. Conversely, since rehabilitation may have increased their functional abilities and confidence with movement, residents may be more active thereby increase opportunities for falls. Clearly the relationship between falls and rehabilitation in LTC is complex, unlike the clear benefit of exercise for preventing falls for community-dwelling older adults.[89]

To change practice, guidelines for quality improvement emphasize a structured and organization-wide approach.[91] Therefore, future intervention studies should examine the effect of sufficiently intense multicomponent rehabilitation programs, targeted appropriately at residents, and embed elements of rehabilitation into daily care practices. Furthermore, an exploration of care practices in provinces with superior performance on the QIs should be conducted to determine the effect of elements of care or policies not captured in the current study. For example, LTC homes in Manitoba performed better on the QIs measuring worsening of ADLs. However, none of the variables in the current study remained significant in any of the models for Manitoba. Further

investigation is needed to determine why Manitoba LTC homes are performing superiorly in these QIs.

An unexpected finding of our study was that the proportion of residents with a diagnosis of multiple sclerosis and hip fracture were frequently associated with performance on the QIs. Residents who have experienced a hip fracture or have multiple sclerosis may have more potential to improve their ADLs since they have experienced an acute event or could have remission of their disease. To support this hypothesis, we found that a higher proportion of residents with hip fracture in LTC homes in British Columbia was associated with performing better on the QI measuring the proportion of residents with improved late-loss ADLs. Residents may become dependent in bed mobility because of the hip fracture, but are able to improve as the fracture heals and they receive rehabilitation. However, given the cross-sectional design of our study it is unclear whether this association persists over time. Indeed, as many as 50% of LTC residents who experience a hip fracture become dependent in their ADLs or die within 6 months.[92] Second, previous research has shown that residents who have multiple sclerosis or hip fracture are more likely to receive rehabilitation services.[8] Therefore, if there is a higher proportion of residents with hip fracture or multiple sclerosis, there may also be a higher proportion of residents with the potential to improve who are receiving rehabilitation. Additionally, a focus on mobility may be a more obvious target for rehabilitation for residents with hip fracture and multiple sclerosis, resulting in changes in ADLs and falls. Other residents may have competing therapeutic

goals, such as decreasing pain or improving quality of life. Therefore, rehabilitation would be less likely to affect ADLs and falls for those populations.

Our study is not without limitations. As described above, we were only able to capture the amount of rehabilitation provided rather than the elements of the rehabilitation intervention. Additionally, minutes of rehabilitation are captured in the 7 days before assessment, which may lead to an underestimation of the amount of rehabilitation provided if residents received it less recently. There may also be issues with data entry, where the number of rehabilitation minutes are not accurately entered into the RAI-MDS. Second, we were unable to control for corporate ownership of many homes, which may mediate the relationship between the amount of rehabilitation provided and performance on QIs. Indeed, previous work has shown an effect of for- and not-for-profit status on QIs, and rehabilitation patterns could vary based on ownership patterns.[93,94] Our study was also cross-sectional in design, so we cannot establish temporal relationships between rehabilitation and the QIs. Finally, we were not able to explore the relationship between rehabilitation and the other important QIs, such as mood and health-related quality of life. However, this is an area for future work.

CONCLUSION

ADL and falls QI scores varied widely across the four provinces. There was no consistent relationship between the proportion of residents receiving rehabilitation services within LTC homes and performance on the ADL and falls QIs. However, the proportion of residents receiving nursing rehab services in Alberta was consistently positively associated with improved performance on prevention of ADL decline QIs. The proportion of residents with multiple sclerosis or hip fracture were often associated with QI performance. Future work should explore rehabilitation practices in provinces with superior performance on QIs, and intervention studies should examine the effect of sufficiently intense multicomponent rehabilitation programs, targeted appropriately at residents, and embed elements of rehabilitation into daily care practices.

CHAPTER 6 – STUDY 4

Evaluating the effect of a rehabilitation policy and service change on facility-level activity of daily living and fall quality indicators in Ontario long-term care homes

INTRODUCTION

There is significant debate around the best model of funding and delivery of health care services nationally and internationally, including long term care (LTC). For example, in the late 1990's the United States experienced a shift to prospective payment LTC sector. Funds were allocated based on the resident characteristics that relate to the intensity of care and services that the resident required.[95,96] For example, residents who received rehabilitation also received more money. After the shift, there was an increase in the number of residents receiving rehabilitation. This brought to light that payment for rehabilitation should be tied not only to amount provided but also to appropriateness of services.[96] Indeed, there continues to be a transformation in the United States healthcare system from fee for service to value based reimbursement methods including bundling services for episodes of care.[97,98] In Canada, providing value based rather than volume based reimbursement has also been identified as a priority.[99,100] With growing health care costs, value-based, block funding encourages health care providers to be accountable for the quality of services provision by presenting a financial incentive for improved coordination of care and avoidance of unnecessary costs.[97,99] While change to a block based payment

system has resulted in reduced costs and improved coordination of care,[100-102] the effect on the quality of care has not been evaluated.

A new policy was implemented for publicly funded physical therapy (PT) in Ontario in August 2013.[3] Publicly-funded PT was removed from the Ontario health insurance act and was reformed to a budget based program. PT service providers now receive a block of funds per bed per year, rather than the previous fee-for-service model that was directly billed to the Ontario Health Insurance Plan (OHIP).[3,103] The new model includes strict eligibility criteria where PT is to be used to improve physical function and mobility rather than providing maintenance and exercise programs. Residents now must be discharged once therapeutic goals are achieved or can be achieved in other programs such as exercise, falls prevention or activation (e.g., therapeutic recreation programs).[3] An additional per diem allotment was provided for residents to participate in general falls prevention and exercise classes that may or may not be provided by a physical therapist.[103,104]

The intention of the change was to improve access to publicly funded rehabilitation services across Ontario, to improve efficiency and accountability, and to shift from a volume based billing model fraught with potential and real abuse to a block based model placing resources where they are most needed.[3,101] While the reform was designed to improve PT service delivery in LTC and was supported by the Ontario Physiotherapy Association,[105] the resultant changes were controversial with court cases attempting to challenge the reform[106] and potential indirect disruption to other rehabilitation services such as occupational

therapy.[107] Unanswered questions remain regarding the effect of the policy and funding change for PT in LTC in Ontario. Therefore, the objectives of the current study were: 1) to describe and examine the proportion of residents receiving rehabilitation services, and in the ADL and falls QIs before and after the policy change, and; 2) to evaluate the effect of the policy change on facility-level ADL and falls QIs. Facility-level ADL and falls QIs were chosen as they are the most commonly used construct to evaluate the effect of rehabilitation interventions in LTC,[17] and have previously been identified as potential measures of quality of rehabilitative care (see Chapter 4 - Study 2). We hypothesized that the proportion of residents receiving PT and OT would decrease after the policy change, and that there would be a decrease in performance on the ADL QIs, specifically the ones measuring mid-loss ADL performance.

METHODS

The study was a retrospective, secondary data analysis. Data was obtained from the LTC Facility Resident Assessment Instrument (RAI) 2.0 (Centers for Medicare & Medicaid Services, Baltimore, MD) for all LTC homes in Ontario. Complex continuing care facilities were excluded from the analyses, as their levels of service provision are different from those of LTC homes and they did not experience the same change in service provision. The RAI 2.0 is a valid and reliable standardized assessment tool administered by trained assessors within

LTC homes, which combines chart review with interaction with residents, their families and the clinicians who work with them.[69-71] The RAI 2.0 is administered in many Canadian LTC homes within 14 days of admission, on a quarterly basis thereafter, or if there is a significant change in status.

For the current study, QIs are defined as aggregated resident-level data expressed as a fraction where the numerator is the number of residents with a particular outcome, and the denominator is the number of residents at risk for developing that outcome who are not otherwise excluded.[18,65] QIs have been shown to be have adequate to good reliability, and to validly capture quality of care activities and strategies within the home.[52,53] The calculated QIs were risk adjusted through restriction, indirect standardization, and stratification with direct standardization to allow for fair comparison across residents and facilities.[72] Restriction excludes residents that do not reflect the quality of care within a home (e.g., new admissions). Residents are then sorted into strata based on their risk level (i.e., low, medium, and high) relative to a cross national standardization sample. Indirect standardization was performed within each stratum by performing multivariable adjustment for individual resident level characteristics (e.g., cognition). Table 11 provides a detailed description of covariates used for adjustment for each QI. Regression coefficients were used to determine the expected number of residents triggering the QI in a given facility, and strata-specific scores were combined using weights from the standard population, to provide a final absolute value between 0 and 1.[72] Homes with QI denominators with a value fewer than 30 were excluded, as the estimate

becomes unstable at this point. Table 11 provides a description of the seven ADL and one falls QI that were calculated for each facility in Ontario for all fiscal quarters (3-month periods) between the period of January 1st, 2011 to March 31st of 2015.

The proportion of residents receiving rehabilitation services (PT, occupational therapy, nursing rehab, therapeutic recreation, and speech language pathology) in Ontario is presented as percentages for each fiscal quarter (3-month periods) from January 1st, 2011 to March 31st, 2015. The proportion of residents receiving PT at four levels was also presented, and was calculated in accordance with the Resource Utilization Groups-III (RUG-III) rehabilitation classifications: 1) those receiving no PT; 2) those receiving less than 45 minutes on less than 3 days of the week; 3) those receiving 45 to 150 minutes on 3 to 5 days of the week; 4) those receiving more than 150 minutes on more than 5 days of the week.[108] The proportion of residents receiving each rehabilitation service was calculated by dividing the number of residents receiving the service by the number of assessments within the home.

To describe the trend in ADL and falls QIs over time, a box plot for each QI across each fiscal quarter was created. Since the 20th and 80th percentile and median are clinically meaningful for QI interpretation,[67] the box plot was created such that the bottom on the box represented the 20th percentile, the top represented the 80th, and the line inside the box indicated the median. A linear mixed regression model using a Toeplitz covariance structure was run to test the effect of policy change on the QIs, and random intercept and slope models were

tested. The policy change was entered as a variable in the model with a value of 0 prior to the second fiscal quarter of 2013, and a value of 1 afterwards. Since PT was the main variable of interest, the proportion of residents receiving each of the four amounts of PT and the interaction between the policy change and the amounts of PT were examined in individual models adjusted for facility-level covariates. Variables were retained within the model at a significance level of $p < 0.01$. The facility-level covariates which each model was adjusted for were: the size of the LTC home (small: 1-29 beds, medium: 30-99 beds, or large: 100+ beds), whether the facility was in an urban (>100 000 people in a metropolitan area) or rural (10 000-100 000 people) location,[109] the health region the home in which the home is located (the fourteen, local health integrated network (LHIN) in Ontario), and the neighbourhood income quintile. All statistical analyses will be completed in SAS version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

The effective sample size was 589 homes (Table 18). Most homes were large (61.6%) and in urban areas (78.4%).

Table 18. Description of facility level variables

	Ontario	
	N	%
Number of homes	589	
Size of home		
Medium	226	38.4
Large	363	61.6
Rurality		
Urban	462	78.4
Rural	127	21.6
Neighbourhood income quintile		
Lowest income quintile	140	23.8
2nd quintile	107	18.2
3rd quintile	125	21.2
4th quintile	113	19.2
Highest income quintile	104	17.7
Health Region		
1	35	5.9
2	71	12.1
3	33	5.6
4	84	14.3
5	22	3.7
6	25	4.2
7	36	6.1
8	47	8.0
9	66	11.2
10	36	6.1
11	58	9.9
12	26	4.4
13	37	6.2
14	13	2.2

Rehabilitation services over time

After the policy change, fewer residents received PT overall (Figure 8). Prior to the change, 84.6% of residents received any PT on average across homes, compared with 56.6% afterwards (Figure 8). In the fiscal quarter from October 1st to December 31st, 2010, residents who received PT received a mean of 49.1 minutes of PT over 2.9 days, and a median of 45.0 minutes of 3.0 days. From January 1st to March 31st, 2015 residents who received PT received a mean of 44.2 minutes of PT over 2.5 days, and a median of 45.0 minutes over 3.0 days. Therefore, fewer residents are now receiving PT overall but the residents

receiving PT are on average receiving the same amount. There was an increase in the proportion of residents receiving the lowest amount of PT (less than 45 minutes on less than 3 days per week) from 18.2 to 22.2%, and a decrease in those receiving 45 to 150 minutes over 3 to 5 days of the week from 65.8 to 32.9% (Figure 8). However, the proportion of residents receiving more than 150 minutes over more than 5 days remained very small (0.5 to 0.2%) (Figure 8).

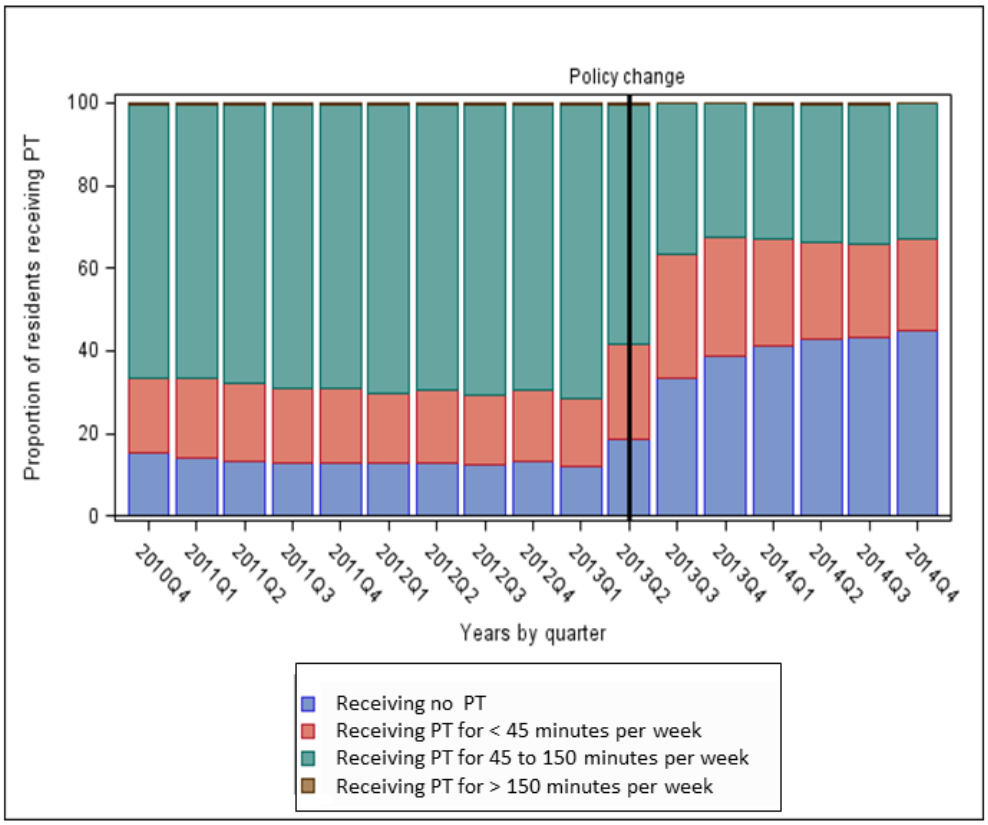

Figure 8. The proportion of residents receiving four levels of physical therapy from 2011 to 2015.

PT=physical therapy; Q=quarter

There was a steady decrease in nursing rehab from more than 42.0% to 16.8% from 2011 to 2015 (Figure 9). However, the decrease does not appear to be influenced by the policy change (Figure 9). Similarly, the proportion of

residents receiving therapeutic recreation services decreased from 9.8% to 6.3%, and did not appear to be affected by the policy change (Figure 9). Less than five percent and less than one percent of residents received occupational therapy and speech language pathology services, respectively, regardless of time (Figure 9). Yet, the proportion of residents receiving occupational therapy decreased from 2.5% to 1.0%, and the decrease was steeper after the policy change (Figure 9). The proportion of residents receiving speech language pathology remained at 0.3% across time (Figure 9).

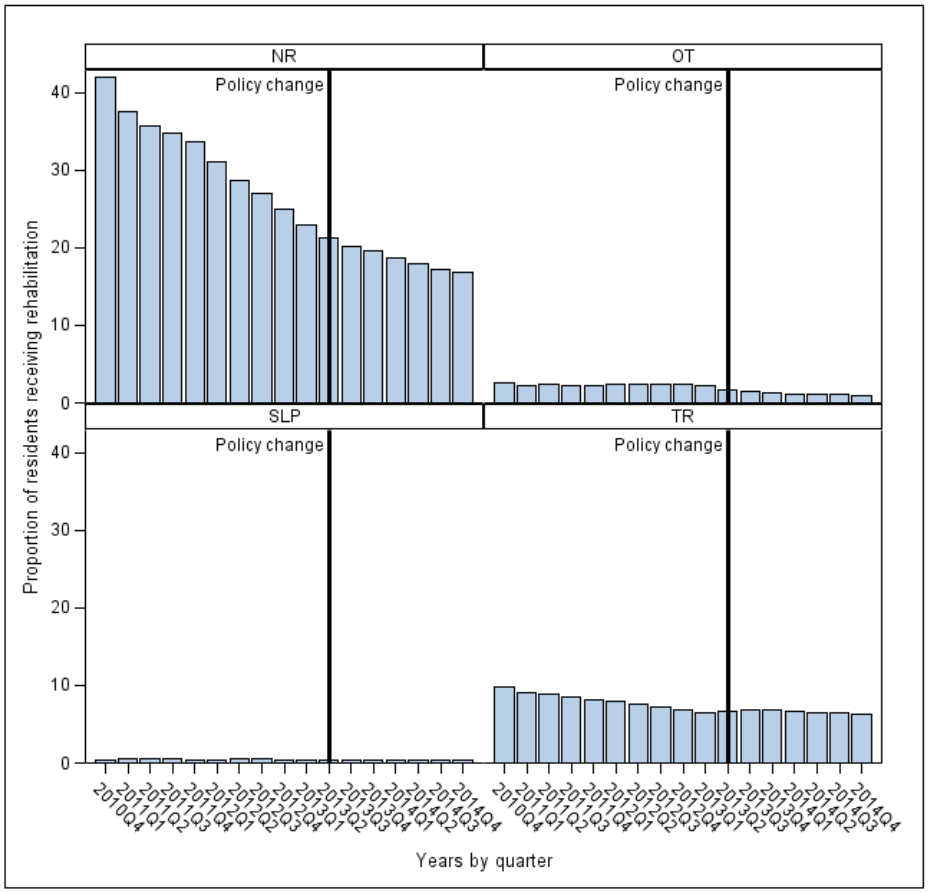

Figure 9. Proportion of residents receiving rehabilitation (occupational therapy, speech language pathology, nursing rehab, and therapeutic recreation) from 2011 to 2015.

NR=nursing rehab; OT=occupational therapy; SLP=speech language pathology; TR=therapeutic recreation; Q=quarter

QIs over time

Figure 10a shows the QIs where a higher score on the QI reflects higher quality, while Figure 10b shows the QIs where a lower score reflects higher quality. The change in median values for the QIs measuring improvement in early- (0.21 to 0.18), mid- (0.32 to 0.30), and late- (0.11 to 0.90) loss ADLs, and worse mid-loss (0.32 to 0.34) ADL function all demonstrated worse quality from 2011 to 2015 (Figure 10b). Conversely, the QIs measuring the proportion of residents with worse early-loss and late-loss ADLs improved over time, with median scores decreasing from 0.35 to 0.30 and 0.18 to 0.16 from 2011 to 2015, respectively (Figure 10a). The QIs measuring the proportion of residents with worse ADLs overall and who have fallen in the last 30 days fluctuated over time but essentially remained unchanged from 2011 to 2015, with median scores around 0.34 and 0.15, respectively. The spread between the 80th percentile and 20th percentile scoring homes remained approximately the same for all QIs (Figure 10a and 10b), indicating the difference between homes scoring excellent and poor remained unchanged over time.

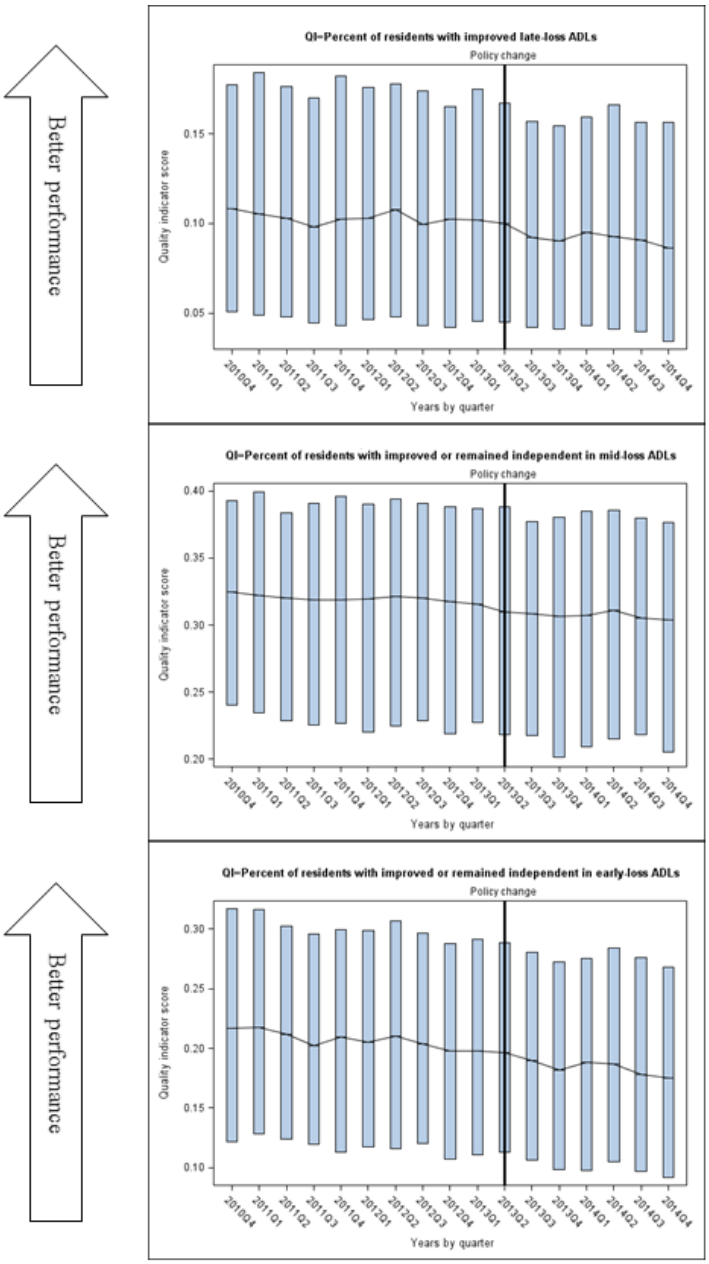

Figure 10a. Distribution of quality indicator scores from 2011 to 2015, for quality indicators where a higher score indicates better performance

Note: The top of the box represents the 80th percentile, the bottom represents the 20th, and the centre bar represents the median

QI = quality indicator, ADL=Activities of daily living

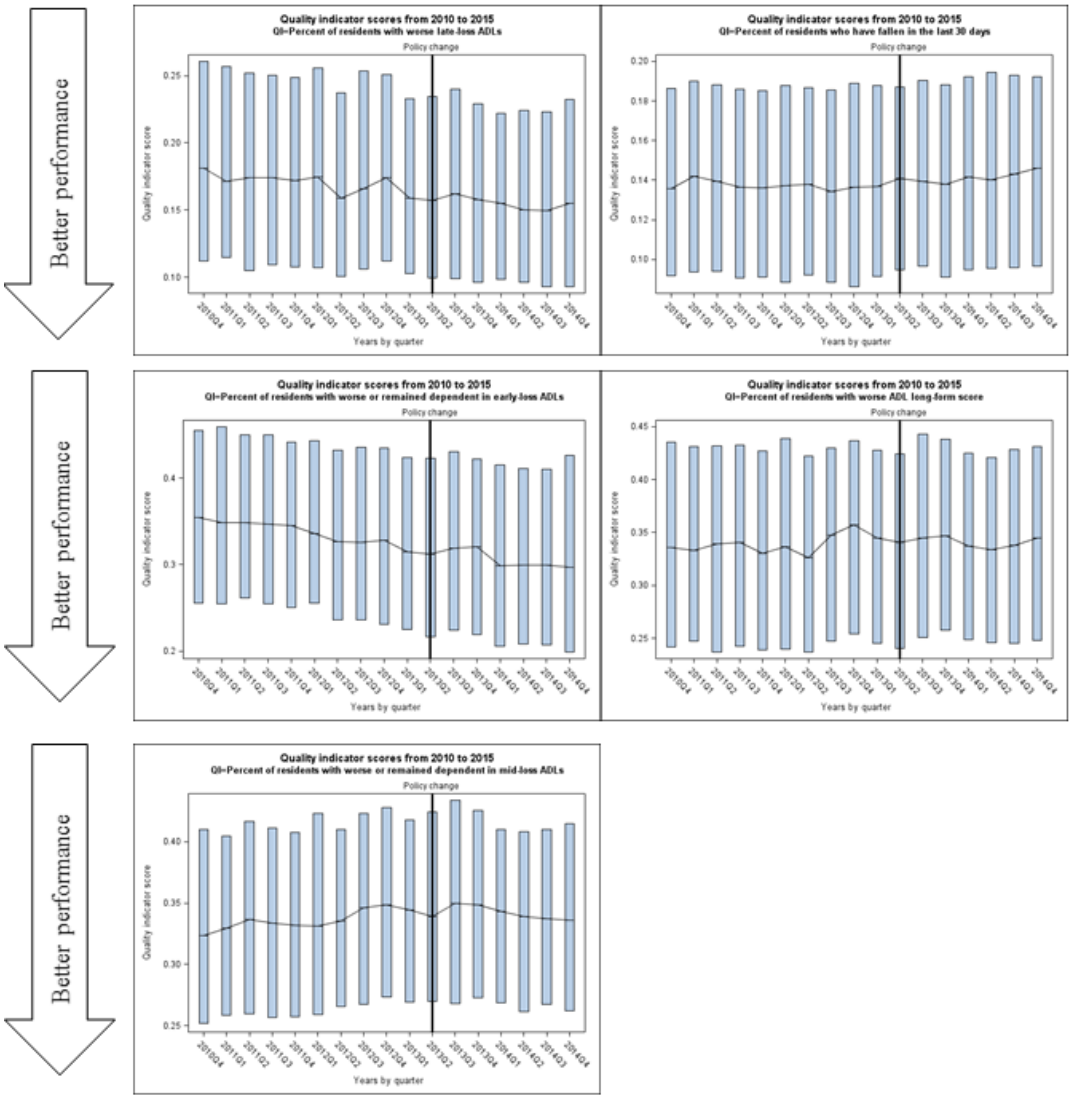

Figure 7b. Distribution of quality indicator scores for 2011 to 2015, for quality indicators where a lower score indicates better performance

Note: The top of the box represents the 80th percentile, the bottom represents the 20th, and the centre bar represents the median

QI = quality indicator, ADL=Activities of daily living

Effect of the policy change on QIs

At the bivariate level, a higher proportion of resident not receiving any PT was only statistically significantly associated with poorer performance on the QIs measuring the proportion of residents with worse overall ADLs and who had fallen in the last 30 days (Table 19). When the interaction between receiving no PT and the policy change was entered into the model, it remained statistically significant for the QIs measuring the proportion of residents with improved late-loss and early-loss ADLs, with higher proportions of residents not receiving PT associated with worse performance on the QIs (Table 20).

The proportion of residents receiving PT at the lowest amount (less than 45 minutes over less than 3 days) did not have a statistically significant relationship with any of the QIs in any of the bivariate models (Tables 19 and 20). However, once entered into the models as an interaction term between the lowest amount of PT and the policy change, there was a statistically significant ($p<0.01$) relationship with improved performance on the QIs measuring the proportion of residents with worse late-loss, early-loss, and overall ADLs (Table 19). This means that there is a positive relationship between the lowest amount of PT and improved performance on the QIs measuring prevention late- and early-loss ADL decline. Conversely, the interaction between the proportion of residents receiving the lowest amount of PT and the policy change was significantly associated with poorer performance on the QIs measuring the proportion of residents with improved late- and early- loss ADLs. That is, after the policy change the proportion of resident receiving the lowest amount of PT was

associated with better performance for preventing early- and late-loss ADL decline but worse performance at improving the same ADLs.

In the bivariate models, the proportion of residents receiving the second amount of PT (45 to 150 minutes over 3 to 5 days) was associated with improved performance on the QI measuring the proportion of residents with worse overall ADLs and falls, and with poorer performance for worse early-loss and improved early-loss ADLs. The interaction with the policy change and the second amount of PT was statistically significantly associated with improved performance on the QIs measuring the proportion of residents with worse late-loss, and improved late- and early-loss ADLs (Tables 19 and 20). In conclusion, after the policy change, the second amount of PT was associated with better performance on the QIs measuring prevention of late-loss ADL decline, and improvement of late- and early-loss ADLs.

Contrarily, the proportion of residents receiving the highest amount of PT (more than 150 minutes over more than 5 days) only remained significant in the bivariate models where it was associated with improvement on all the QIs measuring a decline in ADL status and falls (Table 19). There was no statistically significant relationship with the interaction between the highest amount of PT and the policy change for any of the QIs. Table 21 provides a summary of the results for the effect of the policy and service delivery change on the QIs.

Table 19. Bivariate and interaction with policy change estimates for the quality indicators where a lower score indicates excellent performance

		Quality Indicators – proportion of residents with:				
		worse late loss ADLs	worse or remained dependent in mid loss ADLs	worse or remained dependent in early loss ADLs	worse ADLs[1] long form score	falls in the last 30 days
Parameter (proportion of residents per home)	Model	Estimate (95% CL)	Estimate (95% CL)	Estimate (95% CL)	Estimate (95% CL)	Estimate (95% CL)
Receiving no physical therapy	Bivariate	0.006 (-0.004, 0.016)	-0.011 (-0.022, 0.000)	-0.0153 (-0.028, -0.003)	0.018* (0.005, 0.031)	0.010* (0.003, 0.016)
	Interaction with policy change	-0.010 (-0.028, 0.007)	-0.006 (-0.025, 0.013)	0.028 (0.005, 0.051)	-0.014 (-0.036, 0.008)	0.008 (-0.003, 0.019)
Receiving physical therapy for < 45 minutes on < 3 days	Bivariate	0.008 (-0.001, 0.018)	0.008 (-0.003, 0.018)	-0.004 (-0.016, 0.008)	0.015 (0.003, 0.027)	0.007 (0.000, 0.013)
	Interaction with policy change	-0.026* (-0.043, -0.009)	-0.007 (-0.026, 0.011)	-0.003* (-0.055, -0.013)	-0.036* (-0.057, -0.014)	-0.010 (-0.021, 0.000)
Receiving physical therapy for 45 to 150 minutes on 3 to 5 days	Bivariate	-0.006 (-0.014, 0.001)	0.003 -0.005, 0.011)	0.017* (0.007, 0.027)	-0.016* (-0.026, -0.007)	-0.008* (-0.013, -0.004)
	Interaction with policy change	-0.019* (0.005, 0.034)	0.011 (-0.005, 0.027)	0.007 (-0.011, 0.025)	0.02 (0.002, 0.039)	-0.006 (-0.015, 0.003)
Receiving physical therapy for > 150 minutes on > 5 days	Bivariate	-0.158* (-0.227, -0.088)	-0.167* (-0.243, -0.091)	-0.201* (-0.285, -0.117)	-0.3* (-0.344, -0.167)	-0.107* (-0.151, -0.063)
	Interaction with policy change	-0.085 (-0.289,0.118)	-0.053 (-0.276, 0.169)	-0.076 (-0.335, 0.181)	-0.08 (-0.337, 0.174)	0.032 (-0.099, 0.163)

ADLs=activities of daily living; CL=95% confidence limits; *P<0.01

Note: models are adjusted for health region, facility size, income quintile, and rurality, and their interaction terms with the policy change

Table 20. Bivariate and interaction with policy change estimates for the quality indicators where a higher score indicates excellent performance

		Quality indicators – proportion of residents with:		
		improved late loss ADLs	improved or remained independent in mid loss ADLs	improved or remained independent in early loss ADLs
Parameter (proportion of residents per home)	Model	Estimate (95% CL)	Estimate (95% CL)	Estimate (95% CL)
Receiving no physical therapy	Bivariate	0.005 (-0.003, 0.013)	0.008 (-0.005, 0.020)	0.011 (-0.000, 0.022)
	Interaction with policy change	-0.029* (-0.043, -0.014)	-0.009 (-0.031, 0.013)	-0.048* (-0.068, -0.027)
Receiving physical therapy for < 45 minutes on < 3 days	Bivariate	0.006 (-0.002, 0.014)	0.003 (-0.009, 0.015)	0.013 (0.001, 0.024)
	Interaction with policy change	-0.012* (-0.026, 0.002)	-0.025 (-0.047, -0.005)	-0.026* (-0.045, -0.007)
Receiving physical therapy for 45 to 150 minutes on 3 to 5 days	Bivariate	-0.006 (-0.013, 0.000)	-0.006 (-0.015, 0.003)	-0.013* (-0.022, -0.005)
	Interaction with policy change	0.024* (0.012, 0.035)	0.019 (0.002, 0.037)	0.039* (0.023, 0.055)
Receiving physical therapy for > 150 minutes on > 5 days	Bivariate	-0.069 (-0.126, -0.012)	-0.020 (-0.114, 0.074)	-0.065 (-0.155, 0.025)
	Interaction with policy change	-0.087 (-0.252, 0.078)	-0.068 (-0.312, 0.175)	-0.067 (-0.286, 0.153)

ADLs=activities of daily living; CL=95% confidence limits; *P<0.01

Note: models are adjusted for health region, facility size, income quintile, and rurality, and their interaction terms with the policy change

Table 21. Summary of relationship between proportion of residents receiving rehabilitation and performance on ADL and falls quality indicators before and after the policy change

Proportion of residents receiving:	Time in relation to policy change*:	Quality indicators – proportion of residents with: worse late loss ADLs	worse or remained dependent in mid loss ADLs	worse or remained dependent in early loss ADLs	worse ADLs long form score	falls in the last 30 days	improved late loss ADLs	improved or remained independent in mid loss ADLs	improved or remained independent in early loss ADLs
No physical therapy	Before				✗	✗			
	After						✗		✗
Physical therapy for < 45 minutes on < 3 days	Before								
	After	✓		✓	✓		✗		✗
Physical therapy for 45 to 150 minutes on 3 to 5 days	Before			✗	✓	✓			✗
	After	✓					✓		✓
Physical therapy for > 150 minutes on > 5 days	Before	✓	✓	✓	✓	✓			
	After								

ADLs=activities of daily living; ✓denotes association with improved performance on the quality indicator; ✗denotes association with worse performance on the quality indicator; all associations are with P<0.01

Note: models are adjusted for health region, facility size, income quintile, and rurality, and their interaction terms with the intervention

Before=the model with PT covariate entered alone

After=the model with the PT covariate entered as an interaction with the policy change covariate

DISCUSSION

Our study explored the change in rehabilitation services and QIs over time, and the effect of a policy change that occurred in Ontario, Canada in 2013. The overall proportion of residents receiving PT in LTC decreased after the policy change in 2013. Fewer resident received more time intensive PT, but the residents receiving PT received the same amount on average. The policy and subsequent change in delivery of PT was associated with improved performance on several of the ADL QIs. The proportion of residents receiving more time intense PT was associated with improvement of QIs measuring improvement of ADL function, and the proportion of residents receiving less time intense PT was associated with prevention of ADL decline. However, the proportion of residents receiving no PT and the least time intense PT was also associated with poorer performance on ADL QIs measuring improvement. Therefore, though fewer residents are receiving PT overall there is an association with improved performance on certain ADL QIs. Our analyses were conducted at the facility-level. Thus, the results must be interpreted with caution to avoid ecological fallacy, where observations made at the facility-level are interpreted at the resident-level.[73]

Prior to the policy change, a large proportion of residents in Ontario LTC homes received PT services in comparison with other Canadian provinces. Indeed, over 80% of residents in Ontario received PT, while the proportion of residents in the other provinces ranged from 5.8% to 29.5%.[8] Though rates decreased to 55% after the policy change, Ontario still has the highest percentage of residents

receiving PT services. The decrease in residents receiving PT services is expected given the shift to an emphasis on strict eligibility criteria.[3,103] Though a smaller proportion of residents are receiving services, our study demonstrated there was an association with an improvement in performance on several ADL QIs. Specifically, the decreased proportion receiving the second most time intensive PT were associated with better performance on the QIs measuring ADL improvement. Perhaps the improvement is related to the focus on strict eligibility, so residents who would benefit most from PT are receiving it. Unfortunately, there are no studies to date examining the effect of targeted compared with untargeted rehabilitation in LTC. Advances need to be made in developing tools to assist clinicians in determining who to target for rehabilitation services in LTC.

Conversely, after the policy change the proportion of residents receiving no PT and the least time intensive amount of PT (less than 45 minutes over less than 3 days) was associated with worse performance on QIs measuring improvement in ADL function, but also improved performance on QIs measuring prevention of ADL decline. Our results suggest that less time intensive PT may be more effective at preventing decline rather than facilitating improvement. Indeed, small positive effects on ADLs have only been seen in studies where interventions were delivered two to three times per week for 45 to 75 minutes.[17]

However, an aim of the policy change was to shift away from PT services functioning as maintenance and prevention programs, and rather focus on improving physical function and mobility.[3] Residents are to be discharged to

other programs within the home for maintenance such as exercise classes.[3] Granted, there may be a higher proportion of residents receiving "maintenance" PT services because of a lag of paradigm shift from providers who worked before the policy change, or lack of other programs available in the home to accommodate the change. For example, in our study OT services decreased after the policy change and there was no change in therapeutic recreation or nursing rehab services to adjust for the reform. However, therapeutic recreation or nursing rehab categories may not capture the extent to which exercise classes within the home are being delivered by other professionals, such as fitness instructors or kinesiologists. Nonetheless, a recent study revealed that the effects of 3 months of an individually tailored exercise program are reversed within 3 months of detraining.[110] Therefore, future work should determine whether residents who are discharged from PT are supported by other programs within the home, such as exercise classes or nursing rehab, and if these programs are effective at preventing functional decline.

Over the four years included in our study, there was a worsening in performance on QIs measuring an improvement in ADLs, and an improvement on QIs measuring a decline in early-and late-loss ADLs. However, the magnitude in improvement and decline were both small at around 2 to 3 percent. There is no reported clinically meaningful change for any of the QIs, and interpretation of QIs is more meaningful relative to the sample mean.[18,67] Additionally, QIs are indicators of potential problems, and a starting point for further clinical investigation.[67] Therefore, interpretation of the change in QIs over time should

not be placed on the magnitude but on the direction of the change. The worsening in performance on QIs measuring ADL improvement may represent the increasingly complex nature of residents in LTC,[15] while an improvement in prevention of decline in QIs may demonstrate increased awareness of the importance of averting functional loss.

A limitation of our study is that we were only able to report the amount of PT received in the 7 days prior to assessment. We had no data on the goals of PT, or what the PT intervention entailed. Our study may underestimate the proportion of residents receiving PT if they received in the last three months, but not in the last 7 days prior to assessment. We were also unable to gather information on the proportion of residents receiving other programs provided within the home, such as exercise, falls prevention, and activation. However, our study was the first to describe the change in PT services before and after a policy change in the Ontario LTC context and to explore the relationship over time between the proportion of residents receiving services and the performance on QIs.

CONCLUSION

After the 2013 PT policy change in Ontario, fewer residents received PT overall. While controversial, the policy and subsequent PT service delivery change appears to be associated with improved performance on several ADL QIs. However, the proportion of residents receiving no PT and the least time intense PT was associated with poorer performance on two of the ADL QIs after

the policy change. Follow-up with LTC homes is necessary to ensure that homes have services in place to continue with maintenance of function after discharge from PT services.

CHAPTER 7 - GENERAL DISCUSSION

This thesis sought to explore PR in LTC through a thorough examination of the literature, a consensus process to determine which QIs should be used to evaluate rehabilitation, an analysis of the relationship between rehabilitation and facility-level QIs, and the effect of a controversial policy change for rehabilitation service provision in Ontario, Canada. The literature review revealed that intervention trials of PR in LTC are most commonly delivered and evaluated at the resident-level and assess performance-based measures, ADLs, and mood as outcomes. Few studies have used facility-level measures to evaluate rehabilitation. However, the consensus process determined that ADLs and falls facility-level QIs should be used for evaluation, though exact specifications of an ADL QI were not decided. Analysis of seven ADL and one falls QI revealed wide variation across four Canadian provinces, with no consistent relationship with the proportion of residents receiving rehabilitation services except for nursing rehabilitation programs in Alberta. The policy change in Ontario in 2013 saw fewer residents receiving PT overall, but was associated with improved performance on several ADL QIs. However, not all relationships were positive. Indeed, the proportion of residents receiving the least time intense PT was associated with poorer performance on two of the ADL QIs after the policy change.

Use of QIs in evaluating rehabilitation

There is some evidence to support the use of QIs to identify areas for improvement in rehabilitative care in LTC. First, some of the QIs were responsive to the change in PT service delivery after the policy change (Study 4). Specifically, worse early- and late-loss and improved early- and late-loss ADLs were associated with changes in PT delivery over time (see Study 4). These QIs have been shown to be valid indicators of potentially excellent or poor performance within LTC homes.[52,53] Indeed, the QIs measuring the proportion of residents with worse early- and late-loss ADLs have demonstrated a high level of validity and are highly recommended for use.[52,53] Our work indicates that the QIs measuring either a decline or improvement in early- or late-loss ADLs could be used as indicators of rehabilitation quality in LTC homes.

In contrast, there are several reasons not to support the use of any particular QI at this time. First, our study only explored the relationship between rehabilitation and QIs over time in Ontario. When we examined the QIs in our cross-sectional study (Study 3) across provinces there was no consistent relationship between rehabilitation and the QIs. Also, there have been no other studies examining the relationship between rehabilitation and QIs over time (see Study 2). Therefore, it is difficult to draw conclusions about other provinces across Canada or other countries. Second, the relationship was only observed when the QIs were expressed as a continuous value, as in Study 4. There was no consistent relationship between rehabilitation and the QIs when the QI was

expressed as an ordinal scale (values of poor, average, and excellent) as in Study 3. However, previous authors have suggested that emphasis should not be placed on the absolute value of the QI score.[18,67] Rather, QI scores should be interpreted in relation to previous scores of the same home and scores of other homes. Further, QIs are designed to be used as indicators of areas for improvement to guide quality improvement strategies not as measures of quality.[18,67] In short, there is limited evidence of a relationship between rehabilitation and QIs where the QIs are expressed in a meaningful format, and of a relationship in provinces other than Ontario.

The reporting of rehabilitation in the RAI-MDS may be variable or inaccurate across provinces, limiting the ability of our studies to detect a relationship. Issues with data quality for rehabilitation minutes have been identified in Ontario, where there may be an overestimation of services provided.[111] In contrast, rehabilitation minutes may be underestimated in other provinces. In personal communication with clinicians in Manitoba it was identified that rehabilitation staff do not consistently enter their minutes into the RAI-MDS. Consequently, data quality of rehabilitation items in the RAI-MDS needs to be improved across Canada and then the relationship between rehabilitation and the QIs should be examined again. Alternatively, a smaller scale study in fewer LTC homes could thoroughly gather information about rehabilitation services and their relationship with the QIs.

Additionally, merely receiving a particular number of minutes of rehabilitation per week may not be indicative of quality rehabilitative care. For example,

spending 15 minutes in active therapy is very different from spending 15 minutes passively with a heat pack or where the professional is completing forms for assistive aid prescription. Therefore, future work should decide upon a definition of quality rehabilitation in LTC. For example, some elements of the definition could include documented goals that are relevant to residents, and their treatment plan includes a multicomponent exercise program delivered at least 3 days a week for 45 minutes per session, and they are supported by other programs, such as group exercise classes, once they have met their goals and are discharged from PT.

In summary, while some evidence suggests a relationship between rehabilitation and the QIs measuring early- and late-loss decline and improvement, further work is required to firmly establish a QI or a set of QIs that could be used to identify LTC homes with poor or excellent rehabilitation.

Mid-loss ADLs

Contrary to our hypotheses for study three and four, facility-level mid-loss (walking, transferring, and toileting) ADL QIs were not related to the amount of rehabilitation provided. In contrast, the scoping review (Study 1) suggested that many intervention trials use performance-based measures of walking and transferring to evaluate PR in LTC with several showing positive effects. The relationship between rehabilitation in LTC and mid-loss ADLs (i.e., walking,

transferring, and toileting) is an interesting one and raises several questions for discussion.

ADL and falls QIs over time

Few studies have explored QIs over time, especially ADL and falls QIs. No one has studied QIs in relation to a policy change as we did in Study 4. One study conducted in Iceland from 1996-2006[112] and one from the United States from 2003-2005[113] found no significant change in ADL QIs over time. However, these studies only examined decline in late-loss ADLs unlike our thorough examination of early-, mid-, and late-loss ADL QIs. A more recent study from Iceland found that the prevalence of residents with little or no activity and who had fallen worsened over time 2003-2009.[114] The authors concluded the worsening of the QIs over time was partially explained by residents' health and functional status.[114] Indeed, the population in LTC is often functionally dependent. In Canada, 20 to 45 percent of residents have severe impairment in ADLs.[15] Rolland et al.[115] observed 30% of residents in LTC had a decline in ADLs over an 18-month period while only 5% improved. The LTC population is also becoming increasing complex and acute internationally.[31] Given the increasingly complexity, it may be difficult to alter functional dependence in mid-loss ADLs.

The role of PT and OT in LTC

Another point for consideration is that physical therapists in LTC homes often have different roles depending on the home and provinces' policies. For example, some physical therapists may spend most of their time doing assessments of mobility, delegating care to a PTA, and prescribing assistive aids such as walkers. However, in other homes the PT may provide more direct care centered on improving ADLs and preventing falls. Therefore, the role of the PT in the home would affect their ability to influence ADLs and falls. The RAI-MDS data only collects the number of minutes and days of PT, so it is not possible to know what the PT is doing with that time. Additionally, the time a PTA spends with a resident is also reflected in the RAI-MDS data. Thus, in some homes 15 minutes of PT coded in the RAI-MDS could be a 15-minute assessment with a PT or it could be 15-minute treatment with a PTA.

On the other hand, OT minutes are collected and coded separately from PT minutes in the RAI-MDS. Very little OT is provided within LTC homes and in Ontario, it often focuses heavily on wheelchair seating prescription. There is usually little overlap between the roles of PT and OT in the LTC setting. That is, LTC homes are not likely to have PT and OT providing the same types of services. However, in some jurisdictions OT service provision is linked with PT service provision. For example, in Ontario most of the OT provided within LTC homes is contracted in through service providers who provide PT. The link between PT and OT service providers may explain why there was also decrease in OT services after the policy change in Ontario (see Study 4). Regardless,

there is likely to be little effect of OT on the ADL and falls QIs in Ontario since so few residents receive it. Moving forward, the role of PT in LTC should be taken into consideration when interpreting the effect of rehabilitation on mid-loss ADLs, and may be a reason for the lack of a consistent relationship between the QIs and rehabilitation in study three.

Measurement

Measurement issues may be another reason for a lack of association between rehabilitation and mid-loss ADLs. While a systematic review has demonstrated small improvements in overall ADLs, they did not separately analyze mid-loss ADLs.[12] What is different about our studies is that we evaluated mid-loss ADLs aggregated at the facility-level rather than the resident-level, as was measured in most studies described in the scoping review. Unfortunately, no studies to date have explored the relationship between facility-level, mid-loss ADL QIs and rehabilitation. Therefore, it is not possible to compare our results with other studies.

The RAI-MDS is completed by a trained assessor within the home who assesses the residents' actual level of involvement in self-care during the past three days, rather than their capacity for involvement.[116] Contextual and environmental factors within the home, such as time and financial restraints, or concerns for safety may influence what is actually done with resident compared with what they are capable of doing. For example, it would be faster to transport a resident

who walks slowly in a wheelchair than to assist them with walking. Indeed, an estimated 8 to 26% of resident's decline in ADL status can be explained by the characteristics of the LTC home.[117,118] Additionally, residents who are at a high falls risk may be encouraged to remain seated for safety rather than encouraged to walk independently. Therefore, there may be a difference between routine care and the resident's true capacity. Additionally, most studies in our scoping review and the systematic review[12] used the Barthel Index or the Functional Independence Measure not the RAI-MDS ADL scales. However, there was no significant effect of using different measures of ADL dependence (e.g., RAI-MDS, Barthel Index, or Functional Independence Measure) on the outcomes of intervention trials in a subgroup analysis of a meta-analysis.[12] Therefore, using different ADL scales might not influence the observed outcomes.

Another issue arising within the RAI-MDS data is that allied health, such as PT and OT, may not be trained in coding their time or even aware that they are required to code their time. For example, in personal communication with a RAI-MDS coordinator in Manitoba it was revealed that most rehabilitation is provided as OT and that they often provide daily services to many residents. However, in study 3 only a median of 2.5 and 2.6% of residents received rehabilitation for less than 45 minutes and 45 to 150 minutes, respectively (See Study 3). Therefore, there is a discrepancy between what is documented and what is anecdotally being provided. Perhaps there are coding errors occurring where allied health professionals are not entering their time into the RAI-MDS. Our study also demonstrated that LTC homes in Manitoba performed better on

the QIs measuring worsening of ADLs, but none of the explanatory variable remained significant in that model. Errors in reporting rehabilitation minutes may influence our ability to detect a relationship between the QIs and rehabilitation. Allied health professionals should be trained to accurately enter their time spent with residents into the RAI-MDS so that it accurately reflects the amount of rehabilitation provided.

Current rehabilitation interventions

Additionally, are current rehabilitation interventions sufficiently intense to influence mid-loss ADLs? Study three and four reveal that few residents are receiving PT for more than 45 minutes over 3 days of the week. However, Crocker et al.[12] described that rehabilitation interventions that produced small positive effects on ADLs were delivered two to three times per week for 45 to 75 minutes per session. Therefore, current rehabilitation is delivered at a lower intensity than what evidence suggests will produce a small change. Perhaps if fewer residents received sufficiently intense rehabilitation a greater effect on mid-loss ADLs would be observed. Indeed, this may be what is occurring now in Ontario after the policy change. However, it is difficult to test this hypothesis as so few residents are receiving the most time intense PT services (more than 150 minutes over 5 days). Nevertheless, the effect of targeting PT services may be implicit in the fact that fewer residents receiving more time intense PT was associated with improved performance on QIs measuring improvement in ADLs after the policy change.

Goals of rehabilitation

Alternatively, should mid-loss ADLs be the main goal of rehabilitation interventions in LTC? For residents who are unable to stand or walk, targeting mid-loss ADLs would be inappropriate. Some research has suggested a relationship between ADLs and quality of life. For example, ADLs such as dressing, eating, and toileting were shown to have a positive association with health-related quality of life for residents with dementia.[119] However, the same study revealed that walking and transferring were not associated with quality of life.[119] Therefore, distinction between early-, mid-, and late-loss ADLs is potentially important in relation to evaluating rehabilitation and quality of life. For instance, the scoping review demonstrated that most rehabilitation intervention trials in LTC used performance based measures that evaluated walking and transferring (see Study 1). In contrast, study three and four there were few associations between the proportion of residents receiving rehabilitation and mid-loss ADL QIs, which include walking and transferring. The disparity between what is being used to evaluate rehabilitation in the literature and the results seen in practice indicates a need for consulting residents to determine their goals and preferences. Indeed, if walking and transferring are often used to measure the effect of rehabilitation but dressing, eating and transferring are more important to residents because they are related to quality of life then we may need to consider exploring early- and late-loss in addition to mid-loss ADLs, or instead, use a quality of life QI.

Limitations

Subsequently, a limitation of this thesis is the lack of resident voice. Indeed, we were unable to consult with residents to determine their goals for rehabilitation. Recent calls for culture change in LTC have emphasized the importance of resident-driven approaches with relationship-centred models of care[120] where residents participate in planning and decision-making for their own care and outcome measurement considers the resident experience.[121,122] Further, there is little research to date exploring resident perceptions of rehabilitation in the LTC setting. Quantitative surveys have identified maintaining physical function is a priority for older adults in the community,[43] and barriers and facilitators to providing rehabilitation have been identified from a provider perspective.[123-125] However, no studies could be found that consulted residents on their goals for and perception of rehabilitation. A thorough investigation of both objective data regarding ADL functioning and a how residents perceive rehabilitation to benefit their lives is necessary to make a truly informed, resident-centred decision around service provision. Similarly, we were unable to explore the relationship between rehabilitation and other outcomes like health-related quality of life and mood, which were suggested as important in the consensus process (see Chapter 4). Therefore, the results of this thesis should be considered in combination with future work that explores the goals and perceptions of residents with regards to rehabilitation in LTC.

Future directions and recommendations

Several key knowledge gaps and areas for future work were identified throughout this thesis. Outlined below are recommendations for researchers, clinicians, and policy-makers regarding rehabilitation in LTC.

Researchers

First, we should explore residents' goals for rehabilitation in LTC. We should then evaluate PR in relation to those goals that are relevant to residents. Second, intervention studies should include residents who represent the medically-complex population that lives in LTC, and length of stay of residents included in studies should be differentiated. Future studies should examine PR interventions that are realistic and sustainable, which could include sufficiently intense multicomponent rehabilitation programs, targeted appropriately at residents, and that also embed elements of rehabilitation into daily care practices. Future work should also evaluate different models of rehabilitation delivery in LTC. For example, trials could evaluate a delegated versus direct model of care, or a full-time equivalent PT position in LTC homes compared with block based funding per bed per year.

Future studies should also determine elements of current rehabilitation practices that are effective at preventing and improving functional decline. For example, a closer analysis of the rehabilitation practices in provinces with superior QI performance would help determine effective elements of care. Future work could also examine the role of PT, OT, nursing, and recreation therapy in LTC

homes across provinces and external factors that influence practice. For example, do provinces that provide “episodes of care”-based funding have better outcomes than those that provide “fee for service” or “full-time equivalent” services?

InterRAI researchers should continue to develop the RAI-MDS CAPs to ensure residents who would benefit from more intense rehabilitation services are receiving those services. Specifically, receiving PT should be removed as a trigger for the ADL CAP, and future trials should examine the effect of using the CAPs to identify those eligible for time intense PT and those eligible for maintenance programs (e.g., exercise classes) on resident outcomes. Alternatively, a separate “Rehab CAP” could be developed that triggers for residents that delineates which rehabilitation services the resident should be referred to. Items that could be included in the CAP are recent fluctuations in status such as falls, pneumonia, worsening ADL performance, or increasing pain. Additionally, items should be added to the MDS 2.0 to capture the goals of PT provided in LTC. Minutes and days of PT is not enough information to evaluate services. For example, a pick list of goals could be added to the rehabilitation section, including items such as improving transferring ability or managing pain. This information would be invaluable to understand the goals and appropriateness of rehabilitation services provided in LTC.

Clinicians

Physical therapists and other rehabilitation professionals practicing in LTC should ensure they are delivering services that are appropriate and sufficiently

intense to induce change. Trials that have shown small gains in ADLs have used multicomponent exercise programs including strength training delivered in sessions of 45 to 75 minutes on three days of the week.[12,82] Therefore, if the goal of treatment is to improve ADLs, residents should be receiving more time intensive PT. Physical therapists should also take an active role in understanding what factors are used to determine policy around providing rehabilitation in LTC. For example, physical therapists should become familiar with the MDS 2.0 and how it is used in research and policy to make decisions around care provision. Understanding what the MDS 2.0 is and how it is used may help therapists to use it to evaluate their own practices, to enter data accurately, and to use it to advocate for appropriate rehabilitation resources.

Policy makers

The policy change has begun to move rehabilitation in LTC in Ontario in the right direction by increasing accountability and better targeting of services. However, the optimal model of funding and delivery remains unknown. Though the policy change was associated with improvement in QIs measuring prevention of ADL decline, it was also associated with worsening of the QIs measuring ADL improvement for the proportion receiving no PT and the lowest amount of PT. Additionally, QIs measuring improvement in all levels of ADLs (i.e., early-, mid-, and late-loss ADLs) are demonstrating worse performance over time irrespective of PT involvement. It is concerning that on average, Ontario's LTC homes are performing worse at improving residents' ADLs. This is especially concerning for the subgroup of residents that have the potential to

improve. Therefore, I urge policy makers to continue to dialogue with and support researchers around determining the best model of funding and delivery of rehabilitation in LTC.

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Chapter 2

"Protocol for a scoping review of physical rehabilitation interventions in long-term care: tools, models of delivery, outcomes and quality indicators" by McArthur C, Gibbs J, Papaioannou A, Hirdes J, Milligan J, Berg K, Giangregorio L. BMJ Open. 2015 Jun 1;5(6):e007528. Used under CC BY-NC 4.0 (https://creativecommons.org/licenses/by-nc/4.0/) / slight modification to wording throughout.

Chapter 3

A scoping review of physical rehabilitation in long-term care: types of interventions, outcomes measured and tools for determining eligibility

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APPENDIX 1 – Search strategy for scoping review

MEDLINE database searched through the PubMed platform; includes articles 1946-present.
Limit to English only
March 19th 2:30pm
3383 results

Homes for the age*[tiab] OR Home for the age*[tiab] OR Old age home[tiab] OR Old age homes[tiab] OR Long term care[tiab] OR LTC[tiab] OR Nursing home[tiab] OR Nursing homes[tiab] OR care home[tiab] OR care homes[tiab] OR residential care facilit*[tiab] OR skilled nursing facilit*[tiab] OR intermediate care facilit*[tiab] OR assisted living[tiab] OR Residential aged care[tiab] OR Aged care facilit*[tiab] OR Geriatric facilit*[tiab] OR Geriatric care home*[tiab] OR elderly facilit*[tiab] OR Homes for the aged[mesh] OR Long-term care[mesh] OR Nursing homes[mesh] OR residential facilities[mesh] OR Assisted Living Facilities[mesh]
AND
rehab[tiab] OR Rehabilitation[tiab] OR Exercise[tiab] OR Exercises[tiab] OR Exercising[tiab] OR physical therap*[tiab] OR physiotherap*[tiab] OR PT[tiab] OR restorative care[tiab] OR nursing rehab[tiab] OR Rehabilitation[mesh:noexp] OR Exercise therapy[mesh] OR Physical Therapy Modalities[mesh] OR occupational therap*[tiab] OR rehabilitation nursing[mesh] OR early ambulation[mesh] OR rehabilitation[subheading]
AND
Elder*[tiab] OR Older adult*[tiab] OR Geriatric*[tiab] OR Old age[tiab] OR Aging[tiab] OR older people[tiab] OR Elderly adult*[tiab] OR Gerontology*[tiab] OR Aged[mesh] OR Aged, 80 and over[mesh] OR Frail elderly[mesh] OR geriatrics[mesh]

APPENDIX 2 - all articles included in the original scoping review

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APPENDIX 3 – all articles included in the update of the scoping review

(December 2016)

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Appendix 4 - Results for outcome domains with less than 10 articles

Domain of outcome	Pressure ulcers		Infections		Restraints		Emergency department visits	
Level of intervention	Person	Facility	Person	Facility	Person	Facility	Person	Facility
Number of articles	n=7	n=2	n=1	n=2	n=1	n=1	n=0	n=2
Description of intervention								
Mean frequency, days/week (range)	5.3 (5-7)	not reported	5 (5-5)	not reported	3 (3-3)	not reported	- -	not reported
% articles not reporting	14.3	100	0	100	0	100	-	100
Mean time per visit, minutes (range)	43.5 (4-120)	not reported	50.0 (50-50)	not reported	30.0 (30-30)	not reported	- -	not reported
% articles not reporting	42.9	100	0	100	0	100	-	100
Mean length of intervention, weeks (range)	14.7 (2-32)	52 (52-52)	32.0 (32-32)	52 (52-52)	9.0 (9-9)	104 (104-104)	- -	52 (52-52)
% articles not reporting	14.3	50.0	0	50.0	0	0	-	50.0
Type								
Strength only	-	50.0 (1)	-	50.0 (1)	-	-	-	-
Balance only	-	-	-	-	-	-	-	-
Aerobic only	-	-	-	-	-	-	-	-
Flexibility/Range of motion only	-	-	-	-	-	-	-	-
Recreational activities only	-	-	-	-	-	-	-	-
Walking/ambulation only	-	-	-	-	-	-	-	-
Restorative care or rehabilitative nursing	-	-	-	-	-	-	-	-
Passive modality – ultrasound, laser, etc.	57.1 (4)	-	-	-	-	-	-	-
Yoga, tai chi, dancing, Qigong, etc.	-	-	-	-	-	-	-	-
Functional skills training	14.3 (1)	-	-	-	-	-	-	-
Multi-target exercise program, (≥2 of the above)	14.3 (1)	-	100 (1)	-	100 (1)	-	-	-
Individualized rehab program	14.3 (1)	50.0 (1)	-	50.0 (1)	-	-	-	-
Other	-	-	-	-	-	100 (1)	-	-
Unclear or not reported	-	-	-	-	-	-	-	100 (2)

Profession delivering						-		
Physical therapist	28.6 (2)	50.0 (1)	-	50.0 (1)	-	-	-	50.0 (1)
Occupational therapist	-	-	-	-	-	-	-	-
Nursing	-	50.0 (1)	-	50.0 (1)	-	-	-	50.0 (1)
Recreation staff	-	-	-	-	-	-	-	-
PTA or OTA only	-	-	-	-	-	-	-	-
Fitness/yoga/tai chi instructor	-	-	-	-	-	-	-	-
Exercise physiologist	-	-	-	-	-	-	-	-
Interdisciplinary rehabilitation staff	14.3 (1)	-	-	-	-	100 (1)	-	-
Kinesiologist	-	-	-	-	-	-	-	-
Research staff	57.1 (4)	-	100 (1)	-	100 (1)	-	-	-
Other	-	-	-	-	-	-	-	-
Unclear or not reported	-	-	-	-	-	-	-	
Format of delivery								
Group only	-	-	-	-	-	-	-	-
Individual only	71.4 (5)	50.0 (1)		50.0 (1)	-	100 (1)	-	50.0 (1)
Group and individual	-	-	100 (1)	-	-	-	-	-
Unclear or not reported	28.6 (2)	50.0 (1)	-	50.0 (1)	100 (1)	-	-	50.0 (1)